DOCUMENT RESUME

ED 056 460 EM 009 303

AUTHOR Jelden, David L.
TITLE Predicting Success in an Individualized Multi-Media Instruction Program Using Variables of Aptitude and Personality.
INSTITUTION University of Northern Colorado, Greeley.
PUB DATE 71
NOTE 158p.; An inquiry into learner controlled education

EDRS PRICE MF-$0.65 HC-$6.58
DESCRIPTORS Achievement; Achievement Tests; Aptitude; Films; *Individualized Instruction; *Multimedia Instruction; Programed Instruction; Slides; Teaching Methods

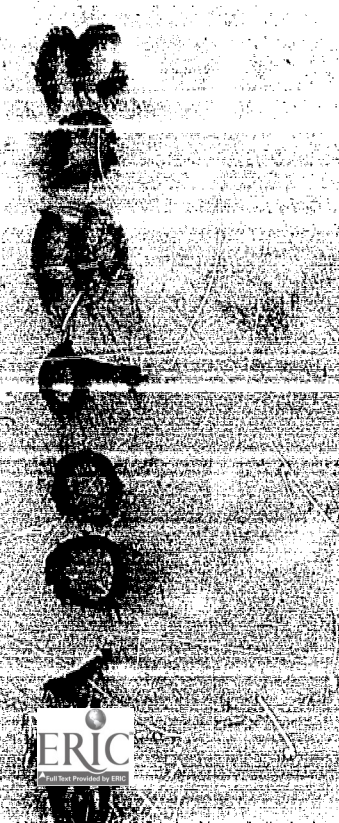
ABSTRACT

A study was devised to investigate the effectiveness of predicting success and failure in an individualized multimedia course in electronics. The media available included programed texts, slides, 16 mm. films, and textbooks. Measures of psychological and ability factors of the 136 subjects who participated were taken by means of the Edwards Personal Preference Schedule (EPPS) and the General Aptitude Test Battery (GATB). Subjects were divided into low and high achievers according to their grade in the electronics course. In addition, data were obtained from personal interviews, teacher anecdotal records, and answers to student questionnaires. Findings suggested that media as a sole means of instruction may not be suited for all learners, but works well for most, and is superior to traditional classroom instruction. Also, results indicated that 1) select factors of the EPPS and GATB (especially intelligence) were capable of predicting achievement within the multimedia environment used for this study, 2) whether the high achiever uses verbal or visual media is not critical since success for him can be achieved with any media, and 3) the majority of students said they liked the system and would recommend its continuance in the course. (SH)

PREDICTING SUCCESS IN AN INDIVIDUALIZED MULTI-MEDIA INSTRUCTION PROGRAM

UNIVERSITY OF NORTHERN COLORADO
GREELEY, COLORADO

DAVID L. JELDEN



PREDICTING SUCCESS IN AN INDIVIDUALIZED MULTI-MEDIA INSTRUCTION PROGRAM USING VARIABLES OF APTITUDE AND PERSONALITY

(An Inquiry into Learner Controlled Education)

A Two Year Staff Study Completed in the Department of Industrial Arts at the University of Northern Colorado, Greeley, Colorado From Spring 1969 to Spring 1971

Dr. David L. Jelden, Professor
Department of Industrial Arts

TABLE OF CONTENTS

PREFACE

This study is an accumulation of data collected over a two- year period in an individualized program of instruction called "Learner Controlled Education."

Much credit for its contents should be given to Dr. James Harmon through whose efforts a pilot study was undertaken and under whose direction, much of the related literature was analyzed. This study was undertaken to replicate the procedures and environment of the pilot study. Several program changes and improvements in classroom operation were made as a result of the pilot study and are thus included in this research.

The "Learner Controlled Education' system was conceived and developed by Dr. David L. Jelden in 1965 as part of the electronics instruction program at the University of Northern Colorado. A description of its basic purpose, philosophy and classroom operation can be obtained in Appendix A of this research report.

Credit for typing, manuscript preparation and development of the final report were facilitated by a grant from the Research and Publications Committee at the University of Northern Colorado. Also a note of appreciation should be made to Dr. Carolyn E. Ritter, Research Consultant at the Computer Center of the university for her suggestions regarding data treatment and programming.

LIST OF TABLES

CHAPTER I

INTRODUCTION

Educational leaders have long been perplexed about how to improve the educational process. Much has been written about the needs and interests of the individual and how these factors should be integrated into the learning experiences of our children. Very little, however, has been written about the ability of a teacher to predict success or failure of students from a psychological-socio-logical point of view. This research was a report of a two-year staff study to find out the effectiveness of predicting success and failure of an individualized educational program called "Learner Controlled Education."[1]

The Process of Education

Educational leaders who have studied many problems in learning have turned up some useful facts. They tell us that: the learners' ability to retain the information they study amounts to---10% of what they read---20% of what they hear---30% of what they see---50% of what

---

[1]See Appendix A for detailed definition of "Learner Controlled Education."

they see and hear---70% of what they say as they talk---and 90% of what they say as they do something.[1]

From these data, we can derive certain essential principles. Among them, students need: (1) a wide variety of experiences which require them to talk and react to what they do; (2) to develop individual responsibility in the skills of independent study related to their individual strengths and weaknesses; (3) opportunities to develop inquiring minds and to develop judgment regarding alternatives; (4) to learn the skills of effective discussion and means of group communication about common problems; (5) to acquire far more complex talents for effectual human relations and (6) satisfaction in learning and in life. A student who experiences direct problem solving will not soon forget. No amount of verbalizing can replace the perceptions and self-realization gained when the student learns in a free and open problem-solving atmosphere. There is no better approach to problem solving than individualized instruction or an independent program which promotes inquiry.

To help promote independent study, it was imperative that the teacher did not view the process of education as a terminal program. An environment was established in the classroom where the student became more responsible for his own education. Only when necessary or when asked did the teacher become a presenter of information and the student a passive recipient of it. An emphasis was placed on the system of identifying more than one source of information. The students were

---

[1]Socony-Vacuum Oil Co. Studies.

asked to experiment with all media to find which single source or combination proved most effective for them. In this way the teacher became another source of information but not the only source.

Teaching and learning are among the most difficult and complex processes to be found in our society.[1] Despite relentless efforts of educators and psychologists to investigate its nature within American education, contemporary understanding of the teaching-learning processes is still not clear.

As more sophisticated techniques become available for evaluating individual differences, a greater emphasis must be placed on preplanning or structuring an educational process utilizing these differences. One can hardly help noticing how people differ--different faces, different statures, different general appearances, different attitudes and preferences, and, of course, less obvious emotional differences. Some children, for example, seek companionship, others do not. No matter what our children are like, we must give them the best education we can by using the best possible methods.

Implications for Teachers

Multiple activity teaching involving individualized instruction requires teachers with a broad background of education and experience, adept in organizing and management procedures. They must be leaders capable of directing and supervising a variety of activities with the assistance and cooperation of the students. They must have the ability to aid students in analyzing and clarifying their objectives and be

---

[1]Frieda K. Merry and Ralph V. Merry, The First Two Decades (New York: Harper and Brothers, 1950), p. 273.

effective in coordinating the student's program towards the realization of those objectives. The effectiveness of the program will, in all cases, be directly proportional to the ability of the teacher. Thus, the teacher education program should strive to develop graduates who have a understanding of self and who can maintain self-esteem and develop an acceptable personality for classroom operation. They should not be so ego centered that suppression of student knowledge is one way to show superiority. Teachers will also need to be interested in children and have the patience, desire and ability to communicate with students. This assumes a psychological base of how students learn and a realization that individual differences do count in structuring an effective educational program.

Therefore, we in education need to develop within our students the individual and necessary skills of learning so that the experiences obtained in a formal school situation will carry into later life. This does not mean that we need to add more methods courses in our teacher education programs, but that in the classes which we now teach in all subject matter areas, the students should have more personal involvement in the learning process. Learning should become an individual, on-going process during and far after the student leaves the full time school.

Much has been written relative to the amount of emphasis being placed on gadgets and hardware in our education programs. In fact, we may be over-emphasizing the gadgetry at the expense of teaching individual learning skills. While industrial arts should make use of all the facilities, techniques and gadgets that it can to increase and enhance learning, these gadgets and bits of hardware should not take the

place of sound understanding on the part of each individual as to how he learns best. We need to teach the technique of learning and the utilization of these gadgets found in educational technology.

Assumptions of the Study

If we as educators will accept the fact that individuals do differ, then it is essential that the teacher and student understand the assets & liabilities in the make-up of each person's aptitude and personality. With a clear understanding of these variables, it would seem that it would be, therefore, possible to predict success in the learning process related to individual aptitudes and personality characteristics. It is with this assumption that this study was undertaken.

Purpose of the Study

The purpose of this study was to investigate the effectiveness of predicting success and/or failure in an individualized, multi-media learning environment. More specifically, the study attempted to answer the following questions:

1. What factors or combination of factors from the Edward's Personal Preference Scale and General Aptitude Test Battery scores were best for predicting term achievement in electronics in terms of course grade?
2. How did high term achievers differ from low term achievers with respect to each of the factors measured on the Edward's Personal Preference Scale and General Aptitude Test Battery?

3. To what extent were each of the factors measured on the Edward's Personal Preference Scale and the General Aptitude Test Battery intercorrelated or dependent on one another?
4. What was the relative frequency of selection of each type of media available for high term achievers?
5. What was the relative frequency of selection of each type of media available for low term achievers?
6. Which sequence of media use appeared for the high term achiever?
7. Which sequence of media use appeared for the low term achiever and how did they differ in their selection of media types?
8. Which Edward's Personal Preference Scale and General Aptitude Test Battery factors were most significantly related to learner selection of media types?
9. How did learners who selected verbal media as first preference differ from those who selected audio-visual media as first choice?
10. What types of students profited most from a multi-media, individualized, self-pacing program of studies? Which profited least as determined by high-low achievers in electronics versus grade point average?
11. What was the learner's attitude toward multi-media, individualized, self-pacing program of studies? Would it be continued in the electronics program at the University of Northern Colorado and in other classes?

12. Did the "Learner Controlled Education" system create a change in attitude regarding the learning process?
13. Were students knowledgeable of their learning assets and liabilities prior to the experience of this class? Had they been formally taught how to study?
14. Which personality and aptitude traits were best for predicting manipulative achievement or psychomotor skill development?
15. Which personality and aptitude traits were best for predicting informational or cognitive achievement in electronics?
16. What recommendations for improvement existed for the present "Learner Controlled Education" program in electronics at the University of Northern Colorado?

Definition of Terms

The following terms are defined as they are used in this study:

1. Learner Controlled Education.--is a system of instruction that is individually oriented, self-instructional, and multi-media in approach. It is based on the premise that students can be taught to interpret the behavioral goals of a course, determine procedures that will permit attainment of the goals, and select and carry out the procedures which they consider desirable for attaining the goals. The Learner Controlled method is in contrast to the teacher controlled method in which the student establishes the goals and determines the approach by

which the outcomes will be reached.[1] The teacher does not impose his method of learning on the student in the system.

2. Ability Traits.--traits of an individual which are directly measured by the General Aptitude Test Battery. These include intelligence, verbal aptitude, numerical aptitude, spatial aptitude, form perception, clerical perception, motor coordination, finger dexterity, and manual dexterity.

3. Auto-Instructional Devices.--the technology of machines and systems devoted to mass instruction, including various applications of television and massed film systems. Sometimes included are those systems or machines for individualized instruction, which include individual reading pacers, individual viewing and listening equipment, language laboratories, and programmed printed materials.[2]

4. Instructional Media.--devices which present a complete body of information, and are largely self-supporting rather than supplementary in the teaching-learning process.[3]

---

[1]Appendix A.

[2]Donald P. Ely, The Changing Role of the Audio-Visual Process in Education: A Definition and a Glossary of Related Terms, U. S. Office of Education Project, Nr. SAE - 9073 under Part B, Title VIII, NDEA (University of Southern California, 1963), pp. T-12.

[3]Ibid.

5. Multi-Media.--methodology based on the principle that a variety of audio-visual media and experiences correlated with other instructional materials overlap and reinforce the value of each other.[1]

6. New Media.--comparatively new devices by which learning situations can be presented to students without the intercession of the teacher; devices which present films, slides, and filmstrips belong in this carrier, also television and teaching machines. Programmed texts have commonly been included also.[2]

7. Pace.--the rate at which the subject is permitted to work through the instructional materials.

8. Program.--a carefully designed sequence of learning situations (frames) which have been developed to the point where students respond correctly to specific criterion items designed to test the behavior taught. Ordinarily, the programs require an overt response to each frame, and then give information concerning the correctness of this response immediately after the student finishes.

9. Personality Trait.--the traits of the individual which were directly measured by the Edward's Personal Preference Examination. Such traits are: achievement, deference, order, exhibition, autonomy, affiliation, introception, succorance, dominance, abasement, nurturance, change, endurance, heterosexuality, and aggression.

10. Response.--a technical, psychological term used by programmers to designate a wide variety of behavior. It may involve the production

---

[1]M. Daniel Smith, New Instructional Media: Self Instruction, Guided Instruction and the Role of the Teacher, U. S. Office of Education Project Nr. 143, Title VII, NDEA (Earlham College, No Date), p. 2.

[2]Ibid., p. 3.

of anything from a single letter, or word, or phrase, to the solution of a problem requiring an hour or more.[1]

11. Self-Instructional Device --a mechanical or program device which presents a set of planned, sequential materials to be learned and which the student can complete in the absence of a live instructor and at his own rate of speed.

12. Individualized Instruction.--defined in this study from three points of view--first, the characteristics of the system, in general; second, the observation of student experiences; and third, the activities and duties of the teacher.[2]

An instructional system is individualized, in general, when:

1. The characteristics of each student play a major role in the selection of objectives, sequence of study, choice of materials and procedures.
2. The time spent by each student in a given subject area is determined by his performance, rather than by the clock.
3. The progress of each student is measured by comparing his performance with his specific objectives rather than with the performance of other students.

An instructional system is individualized to the extent that you observe student experiences, as listed:

1. Have available, in writing, the objectives toward which they are working.

---

[1] Ibid.

[2] National Laboratory for the Advancement of Education, "Definition of Individualized Instruction" (Washington, D. C.: Nov. 18-20, 1968).

2. Work toward a variety of objectives.
3. Use a variety of materials and procedures.
4. Talk freely to each other about their work.
5. Pursue their objectives individually, with small groups of classmates, or with their teachers.

An instructional system is individualized to the extent that you observe the activities and duties of the teacher, as listed:

1. Encourage students to have a variety of objectives.
2. Allow students to move from place to place, based on what it takes to achieve objectives.
3. Spend more time answering questions of individuals and small groups than lecturing to the entire class.
4. Encourage students to help determine the materials they work with and the procedures they follow.

Limitations of the Study

The following limitations were applicable to this study:

1. Only those students who enrolled in the basic course in electricity (IA 180) each quarter including Spring 1969, Fall 1969, Winter 1970, Spring 1970, Fall 1970, Winter 1971 and Spring 1971 were included.[1]

---

[1]A number change on the course occurred during the study. It was previously numbered, IA 80, General Electricity.

2. Only those students who indicated by the pre-test or interview that they had less than a ten-week introductory course in electricity/electronics were included.
3. Only those students who carried no less than nine quarter hours nor more than 18 quarter hours of coursework at the University of Northern Colorado during their class participation in general electricity were included.
4. Individual class size was limited to no less than 15 students and no more than 35 students.
5. Instructional media available for class use were: accelerated and initial contact programmed instruction; 16 mm black and white accelerated and initial contact films; 35 mm tape-slide presentations; teacher lectures; laboratory activities as outlined in the activity packets designed for the course; and a traditional text, Mileaf's Electricity 1-7, published by the Hayden Book Company, Inc.
6. Only those students who had scores on both the General Aptitude Test Battery and the Edward's Personal Preference Scale and who completed the requirements of the course with an assigned grade were included.

Importance and Need for the Study

Contemporary education places considerable emphasis on the recognition of the individual within the learning environment. Total recognition includes the adaptation of the educative structure to best accommodate traits of personality and aptitude of the learner to the content to be mastered. The end result is "Individualized Instruction."

Individualized instruction can be facilitated through the use of educational media such as films, programmed materials, tape-slide presentations, traditional texts, laboratory activities and teacher lectures live or on video-tape. The nature of the individual relates directly to the outcomes of the learning process and, thus, effects the efficiency of the educational process.

Because individuals do differ in their social, manipulative, psychological and physical make-up, some effort should be made by educators to structure a learning "profile" or pattern best suited to the differences of individuals. It is possible that certain media could be best suited to enhance the learning for certain individual profiles.

Students with strong humanistic inter-relations may learn best from group activity, discussions and seminar-type organization. Other students may learn identical subject matter by programmed materials which appeal to individual needs for independent study and continual reinforcement of content. Whatever the problem, it should be understood that most students have or should develop an individual learning style that works well for them. It is the main function of education to provide an opportunity for students to establish this pattern before they leave the full time school.

A review of literature indicates few studies have investigated the application of instructional media to learner characteristics for the purpose of predicting success or failure of the educational process.

CHAPTER II

REVIEW OF RELATED LITERATURE

Introduction

Related literature for this study has been divided into five sections: (1) the nature of past studies in media education, (2) basic assumptions of a media learning environment, (3) the nature of the individual and its relation to the learning process, (4) identification of traits which affect learning, (5) additional select investigations--motivation, the function of the teacher, selection of media regarding the future of and resources for education, and (6) social-psychological characteristics of people and implications for multi-media learning. Within this chapter, each of these sections will be treated separately.

Review of Media Studies in Education

Educational media received a major impetus during World War II with its introduction into foreign language laboratories of the United States Armed Forces. Since this recent beginning, it has grown to find extensive use within public education at all academic levels.

A review of past research studies within the field of the newer instructional media indicates that the nature of these investigations has changed considerably within the past ten years. One significant change has been with regard to the use of media. Earlier studies often regarded media as being primarily an instructor assisted supplementary

device. This contrasts sharply with today's expanded view of media which serve frequently to supplant functions of the teacher, especially with regard to the presentation of informational content.

Early media studies were often attempts to evaluate the newer instructional media through comparative studies with traditional instruction methods. Such studies typically investigated group outcomes without regard for the effects of a media environment on the individual learner. More recently, active research has been directed to investigate the effects of media environments on individual learners. This recent movement has reflected concern for "individualizing" instruction by adapting the media to best suit the individual learner.

Media studies have shown surprising growth during the past few years. Dissertation Abstracts lists an impressive number of such studies. ERIC (Educational Research Information Center) lists in excess of 200 research studies which have been completed between 1956 and 1971, all of which relate to programmed instructional media. Other medias also share similar emphasis, with the rate of such studies increasing annually.

One factor contributing to the growth of the newer instructional media is that media benefits may be applicable to all areas and levels of instruction. Thus, science shares with the humanities and the arts in the benefits accrued from a media environment. Another contributing factor to media growth is the bountiful listing of hypothesized outcomes. These include greater learning, increased learner interest, the opportunity to pursue media learning in a multitude of environments, greater recognition of the individual and lower fiscal costs. These hypothesized

outcomes are sufficient to encourage their investigation through media studies. The United States Government recognizes the possible merits of media instruction, and appropriated two and one-half million dollars under Title 8B of the Higher Education Act of 1965 during its first annual allocation, to be used exclusively to advance research in the new instructional media. Such legislative actions express confidence in media as being able to improve the learning process.

Basic Assumptions of a Media Learning Environment

Although many educators and psychologists would disagree as to the exact nature of the learning process, there are certain principles of learning upon which most authorities would agree. Alvin C. Eurich of the Ford Foundation recently summarized these as follows:

1. Whatever a student learns, he must learn for himself--no one can learn for him.
2. Each student learns at his own rate, and for any age group the variations in rates of learning are considerable.
3. A student learns more when each step is immediately reinforced and strengthened.
4. Full, rather than partial, mastery of each step makes total learning more meaningful.
5. When given responsibility for his own learning, the student is more highly motivated; he learns and retains more.[1]

Eurich, a proponent of mediated instruction, lists the newer instructional media as being capable of fulfilling each of these five principles of learning.

---

[1]I. K. Davies, "The Management of Learning," Industrial Training International (June, 1967), pp. 242-244.

The newer instructional media are unique in their manner of fulfilling these principles. These uniquenesses are in offering

> . . . individualized instruction which liberates a student from the lockstep of a heterogeneous class, lets him move forward at his own best pace, and go as far as he can, releases teachers from much of the routine of exposition and drill and lets them concentrate on smoothing and enriching the progress of individual students.[1]

No other method of learning seems capable of offering such benefits, due to its method of instruction.

These benefits and the manner in which the newer instructional media fulfill the principles of learning reflect the taxonomy of beliefs which serve as guidelines for the newer media. Kapfer refers to these beliefs as a set of assumptions, and lists them as follows:

> The first assumption is that the pupil's responsibility is to learn and that the teacher's responsibility is to make available to the pupil that which is to be learned, places responsibility for the learning-teaching process where it belongs. The teacher does not cover a course, but rather uncovers it; he does not need to cover--or talk about--everything that is to be learned by the pupil.
> The second assumption is that the subject matter of the course must be appropriate to the learner with reference to (1) pace of instruction, (2) level of difficulty of the instructional material, (3) the relevance of the instructional material to reality as perceived by the pupil, (4) the pupil's level of interest, and (5) the individual learning style of the individual.
> The third assumption is that the size of a group, the composition of a group, and the time allotted to a group should be appropriate to the purposes of the group.
> The fourth assumption is that before truly individualized instruction can become a reality, learning packages are needed which can provide for self-paced rather than group paced instruction.[2]

---

[1]Four Case Studies of Programmed Instruction (New York: The Fund for the Advancement of Education, 19640, p. 12.

[2]Philip G. Kapfer, "An Instructional Management Strategy for Individualized Learning," Phi Delta Kappan (January, 1968), pp. 260-261.

Stewart, another recognized authority in remote access informational retrieval systems, lists eight similar assumptions of individualized instruction through the new media. These are:

1. An educator's primary purpose is to facilitate learning by establishing the appropriate environment that is conducive to learning.
2. A less important purpose of an educator is to present information, since the mere presentation of information does not guarantee learning.
3. If learning does not take place, it is possible to obtain the desired learning through appropriate changes after an examination of the learner, method, media, and environment.
4. It is important in an effective and efficient educational system to find out where the student is on the ladder of learning and proceed from that point without gaps or overlap.
5. If the learning objectives of a particular course could be definitely stated and if all of the learners achieved these objectives, they would all receive "A" or some equivalent symbol indicating 90% to 100% achievement.
6. Some learning objectives cannot be defined specifically but can be described as a result of other specific observable and measurable behaviors.
7. Undefinable learning objectives which cannot be tested for existence or cannot be described in terms of other observable and measureable behaviors should not be included as a course requirement for grading procedures.
8. Grades based on undefinable objectives and temperament of the grades do not contribute to an effective and efficient educational system.[1]

Due to the complexity of these basic assumptions, few instances exist where formal education has adopted the newer instructional media to function in its "pure" form. Generally, applied media is found to disregard one or more of the basic assumptions. The reason for such violations is often due to the extensive modifications which must occur

---

[1]Donald K. Stewart, "A Learning Systems Concept as Applied to Courses in Education and Training," pp. 7-10. (Mimeographed.)

before a school can accept media as a means of learning. Changes must first occur in grading structures, understanding of the functions of the teacher, time scheduling of classes, physical environments of classrooms, acquainting the learner with his responsibilities, acquainting the teacher with his new role, fiscal appropriations, and curricular modification.

In retrospect, basic assumptions of the newer media have yet to be fully tested under applied conditions; nevertheless, they are still valued to serve as the guiding force in adoption of all media environments. Such assumptions will serve as the basis on which this proposed study will be based.

The Nature of the Individual and Its Relation to the Learning Process

Several definitions have evolved regarding the exact nature of learning. One such is that learning involves the acquisition of reactions and patterns of behavior which evolve in relation to change in stimulation.[1] The effects of learning are that the learner becomes capable of controlling and improving his environment.

Learning presents a special challenge to the field of the newer instructional media. Experiences must be carefully structured to enhance the learning process to its fullest rewards.

---

[1]M. Daniel Smith, New Instructional Media, Self Instruction, Guided Instruction and the Role of the Teacher, Report No. NDEA-VIIA-143, U.S. Office of Health, Education and Welfare (Richmond, Inc.: Earlham College, 1962).

Since the basis of learning through the newer media is "individualized," the learning experiences must incorporate an understanding of the "individual" as it relates to the learning process.

The learner is indeed a complex organism. He represents several inherent traits which constitute his exact unique nature. Such traits have been categorized as being anatomical, simply psychological traits, complex psychological traits, personality traits, interests, social outlooks, and achievements.[1]

A common characteristic of these traits is that of variance. Typically, individuals have been shown to differ markedly with respect to measures on each of these identified traits. An example of variance is illustrated with measures of intelligence, where the broad range of scores is widely recognized.

Traits of the Individual Which Affect Learning

All traits which describe the nature of the individual either directly or indirectly relate to learning. However, some appear to be more directly correlated than others.

Educators have been cognizant that anatomical traits relate directly with learning and must be recognized within an effective learning situation. Consequently, classroom groupings have typically been by age, sex, and occasionally physical strength. Intelligence has also received attention within educational groupings. However,

---

[1]Richard W. Husband, General Psychology (New York: Farrar & Rinehart, Inc., 1940), pp. 299-300.

extensive efforts to recognize the total nature of the learner has proven impractical, due to practical restrictions within the educational domain. Such restrictions include classroom size, financial considerations, available resources, teacher qualifications, and variations among learners.

With the advent of the newer instructional media, techniques for recognizing additional traits of the learner have become available. Examples of these techniques are reflected in the development of auto-instructional devices which allow for differences in learner pace, complexity of instruction, type of instruction, sensory modes of instruction, and type and frequency of responses. The contemporary need does not seem to be as much to expand media development into new areas; rather, emphasis must be directed to determine how best to apply the existing devices to assure maximum benefit from individual learners. Or, stated in somewhat different terms, the need is to analyze the individual learner to assess how he best learns. Media devices seem capable of recognizing differences among learners.

Far too often, attempts of educators to properly utilize media to recognize individual differences in learning have been less than encouraging. At present, sufficient research has yet to identify the traits of the individual which most relate to effective learning within a media environment. This identification is a prime need before media learning can achieve maximum results.

One enlightening suggestion for the identification of these traits was made by Wing.[1] Nine factors were listed, each of which the author asserts must be controlled to "individualize" learning. These are (1) content of learning, (2) scope of content, (3) pace of learning, (4) sequence, (5) difficulty or depth of the subject matter, (6) mode of sensory presentation, (7) control by the teacher or student or environment, (8) style or mode, and (9) response capability. If learning is examined in terms of these nine factors, with regard to subject-to-subject variances, it appears possible to identify traits which relate to differences in learning. The Wing study, however, did not suggest a means of identifying traits of the individual which reflect recognition of these nine factors.

Doty and Doty have investigated the effectiveness of media in relation to five student characteristics: cumulative grade point average, creativity, achievement need, social need, and attitude towards media instruction.[2] Students involved in the study were one hundred college undergraduates, and the media material consisted of programmed units which were commercially prepared and applied to psychology. Significant correlations were obtained between scores on an achievement test in the programmed unit and grade point average, creativity, and social need. When effects of grade point average were partialed out, significant correlations were observed between achievement

---

[1]Richard L. Wing, Use of Technical Media, CRP, (1948), pp. i, 3.

[2]Barbara Doty and L. A. Doty, "Programmed Instructional Effectiveness in Relation to Certain Student Characteristics," Journal of Educational Psychology (1964), pp. 334-338.

on programmed instruction and social need, suggesting that the latter is an important variable in the media situation. Social need was measured by the Guildford-Zimmerman Temperament Survey, Sociability Scale. The intercorrelations among programmed instruction media achievement and student traits are shown in Table 1.

Moore, Smith, and Teevan have also investigated select traits of the individual as they relate to success within individualized media learning. Select college classes were exposed to programmed materials. Attitudes and achievement were the prime criterion of measurement. The results of this study indicate:

1. High hostile pressure learners (those who express a fear of failure) achieved more than did low hostile pressure learners.
2. High need achievement learners achieved more than did low need achievement learners.
3. High hostile pressure learners achieved more from high error rate than did low hostile pressure learners.
4. High hostile pressure learners had more favorable attitudes towards high error rate than did low hostile pressure learners.
5. High need achievement learners had more favorable attitudes toward high error rate than did low need achievement learners.
6. High need achievement learners had more favorable attitudes toward high error rate than did low need achievement learners.
7. High hostile pressure learners had more favorable attitudes towards program materials than did low hostile pressure learners.
8. High achievement need learners had more favorable attitudes towards program materials than did low achievement need learners.[1]

The research team obtained the eight results, based at a .05 level of significance. Other factors which were thought to merit future

---

[1]J. William Moore, Wendell I. Smith, and Richard Teevan, Motivational Variables in Programmed Learning, NEM 795, 1965.

TABLE 1

INTERCORRELATIONS AMONG PROGRAMMED INSTRUCTION ACHIEVEMENT AND STUDENT CHARACTERISTICS FOR ALL STUDENTS

Variable	2	3	4	5	6
1. Programmed Instruction Achievement	.46[a]	-.2[b]	-.43[a]	-.05	.10
2. Grade Point Average		.14	-.28[a]	.29[a]	.40[a]
3. Creativity		.1	-.02	.19	.09
4. Social Need				.12	.07
5. Achievement Need					.18

[a]p less than .01

[b]p less than .05

consideration were individual motivation and ability. However, no statistical evidence substantiates these two factors within the study.[1]

Summary

The newer instructional media offer a unique opportunity within formal education in "individualizing" the learning process in recognizing significant traits of the individual which relate to learning.

Some traits of the individual have been found to relate more directly to the effects of media instruction than have others. Past research has identified such significant factors as anatomical, social outlooks, and achievement.

---

[1]Ibid.

The investigation of determining which individual factors most relate to media learning is by no means complete. Considerable research remains before "individualized" instruction can achieve maximum benefits.

Additional Select Investigations--Motivation The Function of the Teacher Within a Media Environment, and Individual Selection of Media

Three select problems of media instruction will be discussed in this unit; each relates to areas of investigation included within this study. These are (1) students of motivation within a media environment, (2) the function of the teacher within a media environment, and (3) individual selection of media. One purpose of this proposed study is to extend present understandings of these variables, especially as they relate to college level instruction.

The function of the teacher within a media environment

"There are but two kinds of activity in which a teacher can engage; teachers either manage learning resources or else they operate as a resource."[1] In traditional classroom instruction, the teacher assumes the duties of the latter. Within a media learning environment, the teacher serves to manage learning resources.

The contemporary nature of media growth and development has resulted in several unanswered questions with regard to the function

---

[1]I. K. Davies, "The Management of Learning," Industrial Training International (June, 1967), pp. 242-244.

of the teacher in fulfilling managerial duties. Assistant Commissioner of Education R. Lewis Bright is cognizant of these voids and states:

> There are a great many questions still to be answered. The farther we get into individualized instruction, the more we have to face the fact that things just don't fit into the existing structure. . . . one serious gap in our present efforts is the determination of the teacher's function in the kind of learning the newer educational technology will bring about.[1]

This thesis is further identified and was stated at a recent symposium of educational technology as follows:

> In the age of the computer, the role of the teacher remains to be defined . . . a complete re-education of teachers . . . will be necessary to enable them to cope with the evaluation and selection of (media) . . . material.[2]

What will be the function of the teacher within an individualized media environment? Partial insight into these duties have been stated by Bright as follows:

> The teacher's role will be very different. He will be concerned with the development, convictions, and social actions of his students. The teacher will be student oriented, not subject oriented.[3]

A further understanding of the function of the teacher is furnished by Gruber and Wertman, who investigated the effects of individualized instruction within fifteen college Curricula. These

---

[1]R. Louis Bright, "The Place of Technology in Educational Change," Audiovisual Instructor (April, 1967), p. 341.

[2]From a summation statement at the Symposium of Educational Technology, sponsored by the I.D.E.A., Division of the Charles F. Kettering Foundation, Today's Health (September, 1967), p. 72.

[3]R. Louis Bright, cited by Peter Janssen, "Where New Technology Will Take Education," Nation's Schools (October, 1966), p. 79.

authors state that the teacher should serve primarily as a "catalyst liberating his student's intellectual energies, and as a guide (in) directing them."[1]

Janssen describes the function of the media teacher as being that of an "educational diagnostician--as a teacher of thinking and living, not just a transmitter of data" which will keep education from "developing a mechanized classroom."[2]

Norbert describes the function of a teacher within a media environment as one of "imparting information to the learner (who is) the focal point of the educational process--a shift which frees the teacher for a more creative role, and frees the learner for more active participation."[3]

Stewart further clarified the function of the teacher and states:

> In the typical classroom situation, where the teacher is the presenter of information, the teacher is generally the focus of attention. When courses are developed in accordance to (media concepts), . . . the media replaces the teacher as the presenter of information; learning becomes the focus of attention. The teacher who has now been relieved of the time consuming task of presenting the same information semester-after-semester and year-after-year, can concentrate on the task of teaching. The teacher becomes an educational diagnostician, a director, or a guide to meaningful learning experiences--adapting available

---

[1]Howard E. Gruber and Morris Wertman, Self Directed Study: Experiments in Higher Education, U.S. Office of Education, National Defense Education Act of 1958, Title VII, Project No. 761 (Boulder: University of Colorado Behavioral Research Report No. 19, 1962), p. 1.

[2]Peter Janssen, "Where New Technology Will Take Education," Nation's Schools (October, 1966).

[3]Kenneth Norbert, "The Role of the Media Professional in Education," Audiovisual Instruction (December, 1967), p. 1027.

> materials and environment to the needs of the learner. To perform this role adequately, teachers will also have to become more involved with testing of student achievement and evaluation of curriculum elements.[1]

To summarize the above findings, common agreement seems to prevail as to the generalized nature of the duties of the teacher: these are to fulfill a diagnostic and guidance function--not to serve as the source of knowledge within the classroom. The teacher must be oriented towards the needs of the student, and serve as a catalyst. Since evaluation is an essential element, the teacher must also be knowledgeable with regard to the use of testing and measuring devices.

Past findings tend to agree that the general function of a teacher within a media environment has been categorically defined. However, the exact manner in which a teacher best serves this function, of the problems which he encounters in his daily activities, and of the solutions to these problems has not been clearly identified.

The effects of motivation within a media environment

Hilgard states that effective teaching involves more than the acquisition of knowledge; it must also include the contagious nature of enthusiasm and the involvement with ideas.[2]

It is this writer's thesis that the above statement could be applied to the newer media as follows: effective media environments

---

[1]Donald K. Stewart, "A Learning Systems Concept as Applied to Courses in Education and Training," p. 49. (Mimeographed.)

[2]Ernest R. Hilgard, "The Human Dimension in College Teaching," NEA Journal (September, 1965P, p. 44.

are characterized by two significant results: (1) effective learning of informational (and, if applicable, manipulative) content and (2) the development of student motivation with regard to these learnings.

The extent of past media studies have substantiated newer instructional media as being capable--within limitations--of fulfilling the first of these outcomes, effective learning. However, a review of pertinent literature fails to sustain beliefs regarding the latter outcome. Educators within the field of the newer media seemingly have failed to investigate the influence of media instruction on student motivation.

As applied to the media environment, motivation has two divisions: (1) human relations and (2) non-personal relations. The latter is that which the learner receives due to the acquisition of informational content, and is transmitted from the media or its environment directly to the learner. Human relations are those which are enhanced through personal relationships. Within a media environment, these two divisions are quite unlike those of traditional instruction environments.

One study which examined the effects of motivation within a media environment was conducted by Porter. He states that after a five month period of using (only) teaching machines, there was no indication of lessening student motivation, and the motivation level was deemed quite acceptable.[1] Another study by Lauda supports this

---

[1]D. Porter, "Teaching Machines," Harvard Graduate School of Education Association Bulletin, March, 1968, p. 70.

thesis, and states, "A multi-media approach allows the teacher more flexibility in his presentation, uses less time to present concepts, and generates far greater interest in the learner."[1]

Individual selection of media

A review of past media studies reveals numerous attempts to equate the effectiveness of auto-instructional devices with the results obtained through traditional instruction, when investigated in group situations. Such group studies of the "control vs experimental" nature tend to predominate media studies which are engaged in the measurement of outcomes due to a media environment.

Recently, a movement has begun which questions the rationale of such studies. Stolurow comments as follows:

> Currently in auto-instructional research there is blind reception, if not stubborn persistence in the use of the comparative (control vs experimental) methods of research design. . . . Interestingly, this type of study is inappropriate when we know very little about a complex phenomenon; yet it seems to be at its peak in its compelling quality at the very time it is least likely to be useful.[2]

Stolurow's comments are quite critical of past media studies, and support the thesis that comparative studies are premature, due to the infancy of the newer media; the concern should be for the improvement of existing media, rather than to equate its present embryo stages with those of traditional instruction.

---

[1]Donald P. Lauda, IAVE (December, 1967), p. 36.

[2]Lawrence M. Stolurow, "Implications of Current Research and Future Trends," Educational Technology, ed. by John P. DeCecco (New York: Holt, Rinehart, and Winston, (1964), p. 435.

> In the future we will see more studies in which the purpose is to determine the relative effectiveness of various methods, techniques, or conditions of . . . (media).[1]

One hypothesis concerning the improvement of media which has not been adequately explored is the relationship between types of media and traits of the individual. Perhaps Student A achieves most from a closely structured environment, such as is offered through programmed material. The importance of reinforcement may indeed be important in the learning experiences of particular groups of learners, while its effects are considerably lesser for other groups. Student B may learn best through experiences which allow three dimensional confrontations, while such experiences are of lesser importance to others. Media which appeal to one type of sensory perception may differ in its effects on individual learners.

The dimension of these questions is important if media is to become "individualized" for extensive application. However a review of literature has indicated no studies to exist which have investigated the relative effectiveness of various types of media with traits of the individual, to determine which media, if any, is best suited for the individual learner.

THE FUTURE OF EDUCATION

The basic argument of an individualized method of instruction is that it can and will provide for the flexibility that is needed in future educational experiences. The rapidity of change is making it

---

[1] Ibid.

increasingly difficult for curricula to remain current within the framework of the formal classroom methods that are now commonly used. Further, even if classroom procedures could become more flexible, the traditional method is not amenable to providing for individual retraining and upgrading needs. If man can be taught to teach himself and make use of available resources to attain needed knowledge and skills, then the retraining and upgrading problem can partially be achieved through individual study.

The solution is not all this simple, however. That man can teach himself is self-evident. The majority of man's knowledge and skill likely is self-taught. It is not self-evident, however, that man is naturally an efficient and effective learner in a self-instructional situation. The success of study skills experiments is testimony to the contention that man's skill at learning can be improved.[1,2] Further, the phenomenon of "learning how to learn" that has been put forth also suggests that man learns this ability, and if it is learned, then the degree of this learning in any person would be at some point on a continuum from low to high.[3] Learning procedures are not general for all learning outcomes.[4] Learning strategies may

---

[1]Brown, W. F. and Holtzman, W. H. "Study Attitude Questionnaire for Predicting Academic Success." Journal of Educational Psychology, 1955.

[2]Shaw, J. G. "An Evaluation of a Study-skills Course." Personnel and Guidance Journal, 33:465-468, 1955.

[3]Harlow, H. F. "The Formation of Learning Sets." Psychology Review. 56:51-65, 1949.

[4]Gage, N. "Theories of Teaching" in E. Hilgard (ed.) Theories of Learning and Instruction. Part I, 1964 NSSE Yearbook.

differ in efficiency and effectiveness depending upon whether the outcomes differ in terms such as being cognitive, psychomotor, and affective. This implies then, that man should be taught or should learn those strategies individually that are effective or relevant to the learning outcomes involved in a particular task.

RESOURCES FOR EDUCATION

Even if man can be taught to teach himself, then there is the problem of his having sufficient resources available for learning what is needed. One of the primary tasks of the educator or teacher in the individualized method would be to know what resources are needed for any learning task and to make these resources readily available to the learner. The efficacy of the provision of a variety of resources and learning materials has been demonstrated for young children. A study reported on a 'responsive environment nursery school' in which one of the essential features is the provision of an 'enriched social, vital world' with which the child can interact.[1] Other studies have reported similar results with young children in enriched settings.[2,3]

---

[1]Nimnicht, G. and Meier, J. "A First Year Partial Progress Report of a Project in an Autotelic Responsive Environment Nursery School for Environmentally deprived Spanish-American Children." J Journal of Research Services, 5:3-34, 1966.

[2]Deutsch, M. "Nursery Education: The Influence of Social Programming on Early Development." Journal of Nursery Education, 18, 1963.

[3]Duncan, C. P. "Transfer after Training with Single Versus Multiple Tasks." Journal of Experimental Psychology, 55:63-72, 1958.

The "responsive environment" in a nursery school is essentially an environment in which a wide variety of resources are available for the young learner. The provided variety is not, however, just a random collection of things but rather is a collection of materials in which each component has some purpose.

Although the "responsive environment" procedure has been demonstrated only with young children, it seems reasonable to expect that the same type of situation would operate effectively with other age groups. An adult who is more capable of independent effort that a child should be capable of operating even more effectively in an appropriate "responsive environment" than the young child.[1]

THE SOCIAL-PSYCHOLOGICAL CHARACTERISTICS OF PEOPLE WITH IMPLICATIONS FOR MULTI-MEDIA LEARNING

Dr. O. J. Harvey, Professor of Psychology at the University of Colorado, whose work centers around social psychology, stipulates that education serves as a self-evolving socializing agent.[2] In his research he has tried to establish social 'types' and to see how people operate within a given system. He has looked at the various 'self-systems' of the individual, trying to determine an individual's 'tie structures' or how a person relates to the world around him. This in hopes of

---

[1]Neidt, C. o. Changes in Attitude During Learning Experiences. Colorado State University, 1964.

[2]Harvey, O. J. "The Alienated in Education: A Psychological View." Colorado Journal of Educational Research. Greeley, Colorado: University of Northern Colorado, Bureau of Research, Vol. 8, No. 3 (Spring 1969).

explaining how persons vary in behavior. In general these relationships can be grouped into four main categories or self-systems.

System I

The System I individual is polarized in his evaluations. Things are either black or white, good or bad, right or wrong. He is a dogmatic and authoritarian individual with a high need for structure. He will collect the facts before making up his mind. He will overgeneralize from a few inputs or examples and is very rigid. He is an individual who is unable to see another point of view and tends to be low in flexibility and creativity.

System II

These types of individuals are similar to System I people in structure, but very different in terms of content. The first system can be characterized as the moth who flies invariably toward the light. The people in System II would fly away from the flame. The System II individual is no less determined than those of System I. This type of person is one who tends to reject the basic mainstream of society and who has rebelled against the basic institutions. They have kicked over traces of authority and yet have found nothing to replace them. Their basic orientation to the world is negative, or one rebelling against. They are very highly valuative and polarized in their judgments as System I but in the opposite direction.

System III

People who think high in abstractness. Persons who are ultra-humanistic. They are extremely concerned with peer relations and have

a high degree of dependency upon others. These people try to have relations with others in order to manipulate them into solving their problems for them. These people cannot stand to be alone, nor can they stand to do things on their own. These people have a very high dependency relationship. There is a tendency to have others, who have very low status, the underdog, dependent upon them. In turn, they tend to be dependent upon people who have power. This group tops the game of being identified with the underdog, but in reality they aren't.

System IV

This group tends to be the smallest (5% to 7%) of our society. Individuals in this system are those who are most abstract. They tend to be more personal, not anti-personal; more independent, not negatively independent. Unlike the other groups, they tend to seek more information on which to base their judgments and behave coolly under stress.

If educators can look at the social-psychological ties of students in their classrooms and can understand their needs and relationships to others in the educational environment, it seems reasonable to assume that a multi-media, self instruction environment is the best approach to learning.

Research completed supports the thesis that the best kind of education is one which develops a System IV individual. Oddly enough, teachers who possess the traits of a System IV social tie structure tend to develop students with the same characteristics. An individualized, multi-media, educational environment for a student which is directed by a teacher who is personable, independent, and capable of good judgment

and willing to accept and work with the differences of students will be able to develop graduates who are able to face tomorrow's world.

CHAPTER III

METHODS AND PROCEDURES

Introduction

The purpose of this chapter is to describe the methods and procedures which were used in this study. The chapter is divided basically into four sections; (1) the purpose of the study, (2) description of the environment, (3) collection of data, and (4) method of data treatment.

Purpose of the Study

The purpose of this study was to investigate the effectiveness of predicting success and or failure in an individualized multi-media learning environment. More specifically, the study attempted to answer the following questions:

1. What is the relationship between achievement as determined by grade within a multi-media learning environment and select psychological and ability factors of the individual?

2. What is the relationship between select psychological and ability factors of the individual and the choice of instructional media which was preferred by the learner based on his choice?

3. What is the learner's attitude towards a multi-media individualized self-pacing program of studies?

4. Are students aware of their personality and aptitude traits and how to utilize these characteristics for study purposes?

5. Is there a predictability pattern for select personality and aptitude traits for high and low achievers who have experienced a multi-media individualized program of study?

6. What are the recommendations for improvement for a multi-media individualized instruction program based on the results obtained from this study?

A Description of the Environment

Part I--description of the population

The population in this study consisted of students who were enrolled in the basic electricity course IA 180 within the Industrial Arts department at the University of Northern Colorado. Students in this study were enrolled from spring quarter, 1969, through the spring quarter of 1971. This time span covered a sequence of seven quarters. Students who participated in the study met the following requirements:

1. Their background in electronics did not exceed the equivalent of twelve weeks of senior high school electronics.
2. Each enrolled in a minimum of nine quarter hours of course work during the term under investigation.
3. Each expressed an intent to pursue a four-year academic degree within Industrial Arts education as either their major or minor field of academic emphasis.
4. Individual class size was limited from no less than fifteen students to no more than thirty-five students.
5. Only those students who had scores on both the General Aptitude Test battery and the Edwards Personal Preference Scale and who completed the requirements of the course with an assigned grade were included.

The writer was the instructor for each section. The total enrollment for seven quarters of class work was 196. Of this number,

some students did not meet the qualifications for part of the study and were discarded. The personality and ability traits required to process the predictability profile include 136 students. However, the interviews and general questionnaires were administered to the 196 students.

The IA 180 Basic Electricity course is a required course for all Industrial Arts majors and whereas all Industrial Arts majors are required to have two courses in electronics for graduation, it is assumed that the population of this study is representative of all Industrial Arts majors enrolled at the institution. Furthermore, it is assumed that the Industrial Arts major is not markedly different from the typical student at the University of Northern Colorado.

Part II--media available and its use.

During the first two class meetings, students were introduced by a brief conceptual overview of what a multi-media individualized program of instruction was. Particular emphasis was directed to impart a challenge of its open-ended learning structure as well as in its proposed recognition of individual differences. Students became familiar with the different forms of media which were available within the classroom. These media were: (1) initial contact commercially-prepared program texts and accelerated teacher-prepared program texts, (2) the traditional textbook, (3) 16mm sound films from the Air Training Command, United States Air Force, which were the Educational Television series (ETV) used in the basic electronics instruction program in the Air Force. These films were edited to cover information as outlined

in the course and were analyzed by topic and unit to coincide with the course outline, (4) 35mm slides with tape narrations developed for the packets which were used in the course, (5) the teacher-lecture which was primarily an orientation to each of the packets or discussion of topics requested by the students, and (6) a lab activity as defined and set out in the learning activity packet.(L.A.P.) (An explanation of the learning activity packets can be found in the Learner Controlled Education summary, contained in Appendix A.) Each student was directed in the use of the mechanical hardware which accompanied their respective media offerings. Media material locations and their storage system was explained by the instructor and viewed by each student.

Attempts were made to reduce student fear regarding any usage difficulty of the mechanical hardware which accompanies the various media. Students were informed that they were not to be held responsible for immediate mastery of these devices. If difficulty was experienced, the instructor or a knowledgeable student was to be contacted for assistance. If the student did not regard hardware and its operation as an impeding block in media selection and use, it was felt that classroom activity would more accurately reflect student preference regarding the type of media selected.

For the most part, daily informational content could be obtained from any of several different media. Thus, it was conceivable for a student to view only 16mm sound films throughout the entire term. Similarly, others could interact with only written texts. At times, however, it is recognized that the learner must have interacted with

more than one type of media, although such instances were kept to a minimum.

The following is a description of each type of media:

Programmed materials--Eight commercial programs of the initial contact variety were available for use within the classroom. In addition, ten twenty-two unit accelerated teacher-prepared programs were also available. These programs were written by Dr. David L. Jelden, Industrial Arts Department, at the University of Northern Colorado. There were other programmed materials available, which were commercial productions, but not considered part of this particular study, due to their lack of use.

Traditional Texts--Traditional texts number in excess of 100 which were deemed suitable for use within the investigated classes. Publication dates generally were 1960 or newer; the listing included an excellent representation of most commonly adopted beginning Industrial Arts university or college level electronics textbooks.

16mm Sound Films--Fifty 16mm sound films from a collection of 250 were edited for use within this study. All represented donations from United States Air Force Air Training Command. Such films were from the Fundamentals of Electronics Course (ABR 32020) which was being offered at Lowry Air Force Base, Denver, Colorado. Average running time of the edited films was approximately 17 minutes.

35mm Color Slides with Automated Tape Sound--Twenty-one tape-slide presentations were prepared for use within this study. A number of these presentations were prepared by doctoral graduate students under the direction of Dr. Jelden for use in this study or as requirements from other classes in educational media. The tape-slide presentations were unique in two respects: (1) Narration was furnished by tape recording, and the 35mm color slides were automatically advanced by "tone" which was pre-recorded on the audio tape. (2) A special "response" feature was incorporated, which, at various locations in each presentation, required a student response. The "response" mechanism automatically stopped the sound recording, to permit each student the necessary time to answer the question. When the student selected an answer, he pushed a "response" button, which initiated the starting sequence of the tape recording, and immediately reinforced the student with the correct answer. The mechanic hardware for tape-slide presentations was constructed by Dr. Jim Harmon, who was a graduate student at the university in 1969.

Instructor Presentations--Instructor presentations were scheduled to be given at the beginning of each activity packet as an orientation over what the packet was to cover. This was based on a planned sequence of study which can be found in Appendix B. The sample quarter was spring, 1971. In addition, the instructor was available to give discussion or information when requested by students. Requests occurred approximately three times during each week of the course and lasted about twenty minutes each. Students received no special encouragement to select instructor presentations in lieu of other media types. Attendance at any of the instructor presentations was optional at the wishes of the student.

Lab Activity--Manipulative or psychomotor activity for this study was set out in the learning activity packets. The lab activity was printed on blue paper. An explanation of the Learner Controlled Education activity packet and particularly the use of the lab activity can be found in Appendix A. As with the other media, all lab activities were optional at the discretion of the student.

The learning activity packet was the key to the operation of the multi-media individualized self-pacing program undertaken in this study. A sample learning activity packet has been placed in Appendix C.

Experience during the study allowed the instructor to give an estimate of time which would be spent with each activity packet for completion of the course work within a ten-week period. The time span recommended for the completion of each activity packet was determined by the pilot study, and hence the final schedule which appears in Appendix B.

The instructor kept daily anecdotal records of noteworthy classroom activities. Particular attention was directed towards analysis of student's self-directivity, the nature of duties of the teacher, and the difficulties which were experienced in classroom organization and administration. The instructor spent most of his

time when he was not lecturing or discussing with a small group, circulating through the lab, helping students on an individual basis as problems arose.

Collection of Data

Part I--Sources of Data

In order to answer the questions included and to state the purpose of the study, numerous sources of data were accumulated. Each of these is described in this particular section.

Term Achievement--Term accumulative points were summed for each student. The composite score was a measured term achievement, and hence the grade assigned. Points represented student scores on a formal manipulative and informational test given within the course. The manipulative evaluation was by individual performance tests at the end of the quarter, while the informational achievement was by score on the objective examinations administered at the mid-term and at the completion of the course. Test questions were structured to measure only those learnings that each student was expected to have mastered as listed in the Learning Activity Packet in the form of the behavioral objective.

GATB and EPPS Scores--Each student's record contained his scores on a General Aptitude Test Battery and Edwards Personal Preference Schedule. These tests measured twenty-four psychological and ability factors.

Student Interviews--Each student was interviewed by the writer twice during the term. The objective was to assess student views concerning a multi-media environment and to seek suggestions which would result in improvement of the existing multi-media structure in the beginning course IA 180--General Electricity. The first interview was conducted during the first two weeks of the program to interpret the results of the GATB and EPPS tests to the student for identification of his strengths and individual weaknesses.

Student Questionnaires--Student questionnaires were constructed by the researcher and structured to assess student attitudes relating to specific facets of the media environment. Such facets included the anxiety level of the student in the multi-media environment, the continuance of the learner controlled

education program for succeeding classes, the sequence of media used or preferred by the student, reasons for media preferences, and suggestions for improvement of the media environment regarding quality, organization, and administration.

Part II--criterion measures--the General Aptitude Test Battery and the Edwards Personal Preference Schedule

This section describes the nature of the GATB and EPPS standardized batteries of tests which constituted criterion measurements. The GATB was selected to measure nine select ability factors of the individual learner; the EPPS measured fifteen psychological factors. Each of these select traits was examined to determine its relationship to learning within a multi-media environment.

The General Aptitude Test Battery

The GATB (General Aptitude Test Battery) was selected for criterion measurement, due to its unique ability to measure manipulative aptitudes, and of the extensive standardization which was compiled on its use.

The GATB is a battery of tests which was devised by the United States Security Department as the standard experimental battery for measurement of occupational norms. Its basic purpose is to measure a group of aptitudes within the individual--aptitudes which are found to relate to vocational success--and interpret these scores in terms of a wide range of occupations.[1]

---

[1]United States Department of Labor, Guide to the Use of the General Aptitude Test Battery (Washington, D.C.: Government Printing Office, 1962), pp. 1-5.

The battery consists of nine measures, which were determined by analysis of twelve subtests. The twelve subtests constitute the test battery. Table 2 lists the nine aptitudes and the twelve subtests used to measure these aptitudes.

TABLE 2

GATB APTITUDES AND SUBTESTS

Aptitude	Tests
G--Intelligence	Part 3--Three Dimensional Space Part 6--Arithmetic Reason
V--Verbal Aptitude	Part 4--Vocabulary
N--Numerical Aptitude	Part 2--Computation Part 6--Arithmetic Reason
S--Spatial Aptitude	Part 3--Three Dimensional Space
P--Form Perception	Part 5--Tool Matching Part 7--Form Matching
Q--Clerical Perception	Part 1--Name Comparison
K--Motor Coordination	Part 8--Mark Making
F--Finger Dexterity	Part 11--Assemble Part 12--Disassemble
M--Manual Dexterity	Part 9--Place Part 10--Turn

Each of the nine aptitudes measured by the GATB is described below.

G--Intelligence: General learning ability, ability to grasp instructions and underlying principles. It is often referred to as scholastic aptitude.

V--Verbal Aptitude: Ability to understand the meaning of words and paragraphs, to grasp concepts presented in verbal form, and to present ideas clearly.

N--Numerical Aptitude: Ability to perform arithmetic operations quickly and accurately.

S--Spatial Aptitude: Ability to visualize objects in space and to understand the relationships between plane and solid forms.

P--Form Perception: Ability to perceive pertinent detail in objects or in graphic material, to make visual comparisons and discriminations in shapes and shadings.

Q--Clerical Perception: Ability to perceive pertinent detail in verbal or tabular material, to observe differences in copy and to proofread works and numbers.

K--Motor Coordination: Ability to coordinate hand movements with judgements made visually; speed and precision.

F--Finger Dexterity: Ability to move the fingers and to manipulate small objects rapidly and accurately.

M--Manual Dexterity: Ability to move the hands easily and skillfully, a grosser type of movement than finger dexterity involving the arms and even the body to a greater extent.

The GATB has been correlated with other tests which proport to measure the identical aptitudes. The GATB Guide indicates that the GATB Intelligence "G" factor correlates .78 with the DAT scores, and .66 with the Numerical "N" score; correlation between the GATB and the Otis "G" is .76. Correlation between the Otis Verbal Aptitude and the GATB Verbal "V" is .70, and .77 between the CTMM Language score and the GATB Verbal.[1]

Reliability studies of the GATB are quite extensive, and have generally produced reliability coefficients for most aptitudes to range from .80 to .90. Specifically, the reliabilities of the aptitudes G, V, and N are in the .90 and above range.[2]

---

[1] Ibid., Section III, p. 137.

[2] Ibid., p. 31

Each of the aptitudes measured by the GATB is rather unique, as compared to intercorrelations between the GATB aptitudes. Table 3 shows the intercorrelations between GATB aptitudes based on scores from high school seniors.

The GATB has been extensively adopted for the prediction of vocational success. Since 1950, attention has been directed at its possible use as a prediction of academic success within formal education. Such studies include those of Sullivan,[1] Grote,[2] the University of Utah,[3]

TABLE 3

INTERCORRELATIONS OF APTITUDES OF HIGH SCHOOL SENIORS

Aptitude	G	V	N	S	P	Q	K	F
G--Intelligence								
V--Verbal Aptitude	.73							
N--Numerical Aptitude	.74	.42						
S--Spatial Aptitude	.70	.40	.34					
P--Form Perception	.43	.34	.42	.48				
Q--Clerical Perception	.35	.29	.42	.26	.66			
K--Motor Coordination	-.04	.13	.06	-.03	.29	.29		
F--Finger Dexterity	-.05	-.03	.03	.01	.27	.20	.37	
M--Manual Dexterity	-.06	.06	.01	-.03	.23	.16	.49	.46

[1]Thomas W. Sullivan, "Predicting Success in Vocational-Technical Programs in Community Colleges Using the General Aptitude Test Battery" (unpublished Ed.D. dissertation, University of Northern Colorado, 1967).

[2]U.S. Department of Labor, Section III, p. 177.

[3]Ibid.

and the University of Tennessee.[1] The results of each study were quite favorable, indicating the aptitudes measured within the GATB to be related to achievement.

An extensive review of related literature indicated that the aptitudes measured by the GATB have not been examined within an individualized media environment.

The Edwards Personal Preference Schedule

The Edwards Personal Preference Schedule was designed primarily as an instrument for research and counseling purposes, to provide measures of a number of relatively independent normal personality variables.[2] This schedule was selected for analysis within an individualized media environment due to (1) the unique nature of its measurements (2) the likelihood that its measured personality factors relate to learning, and (3) the availability of data. With regard to the latter, all entering students at the University of Northern Colorado were required to take the EPPS.

The personality factors measured within the EPPS are measurements of "personal goals or motives of the learner . . . each is an attempt to measure why one does what he does."[3]

---

[1] Ibid., p. 119.

[2] Edwards Personal Preference Schedule (New York: The Psychological Corporation, 1959), p. 5.

[3] Ibid.

Table 4 shows the fifteen personality variables of the EPPS.

TABLE 4

FIFTEEN PERSONALITY VARIABLES--EPPS

Achievement:	To do one's best, to be successful, to accomplish tasks requiring skill and effort; to be a recognized authority, to accomplish something of great significance; to do a difficult job well, to be able to do things better than others.
Deference:	To get suggestions from others, to find out what others think, to follow instructions and do what is expected, to praise others, to tell others that they have done a good job, to accept the leadership of others, to conform to custom and avoid the unconventional, to let others make decisions.
Order:	To have written work neat and organized, to make plans before starting on a difficult task, to have things organized, to keep things neat and orderly, to have things arranged so that they run smoothly without change.
Exhibition:	To say witty and clever things, to tell amusing jokes and stories, to talk about personal adventures and experiences, to have others notice and comment upon one's appearance, to say things just to see what effect it will have on others, to be the center of attention.
Autonomy:	To be able to come and go as desired, to say what one thinks about things, to be independent of others in making decisions, to do things that are unconventional, to avoid situations where one is expected to conform, to avoid responsibilities and obligations.
Affiliation:	To be loyal to friends, to participate in friendly groups, to do things for friends, to share things with friends, to do things with friends rather than alone.

TABLE 4 (cont.)

Intraception:	To analyze one's motives and feelings, to understand how others feel about problems, to judge people by why they do things rather than by what they do, to analyze the motives of others.
Succorance:	To have others provide help when in trouble, to seek encouragment from others, to have others be kindly, to receive a great deal of affection from others, to have others do favors cheerfully, to be helped by others when depressed.
Dominance:	To argue for one's point of view, to be a leader in groups to which one belongs, to be regarded by others as a leader, to be elected or appointed chairman of committees, to make group decisions, to supervise and direct the actions of others.
Abasement:	To feel guilty when one does something wrong, to accept blame when things do not go right, to feel that personal pain and misery suffered does more good than harm, to feel better when giving in and avoiding a fight than when having one's own way, to feel inferior to others in most respects.
Nurturance:	To help friends when they are in trouble, to assist others less fortunate, to treat others with kindness and sympathy, to forgive others, to do small favors for others, to show a great deal of affection toward others.
Change:	To do new and different things, to travel, to meet new people, to experience novelty and change in daily routine, to experiment and try new things, to participate in new fads and fashions.
Endurance:	To keep at a job until it is finished, to complete any job undertaken, to work hard at a task, to keep at a puzzle or problem until it is solved, to work at a single job before taking on others.

TABLE 4 (cont.)

Heterosexuality:	To go out with members of the opposite sex, to be in love with someone of the opposite sex, to kiss those of the opposite sex, to be regarded as physically attractive by those of the opposite sex, to become sexually excited.
Aggression:	To attack contrary points of view, to tell others what one thinks about them, to criticize others publicly, to make fun of others, to tell others off when disagreeing with them, to become angry.[1]

The EPPS has been standardized for general adult use, and lists percentile rank scores for each trait. Its internal consistency (reliability) ranges from .60 to .87. With the exception of Deference (r = .60), and Exhibition (r = .61), all other measured personality traits have reliability coefficients in excess of .70.[2] When validated with the Taylor Manifest Anxiety and Guilford-Martin Personal Inventory, EPPS scores which correlated in measurement beyond the .05 level of significance were Deference, Order, Autonomy, Affiliation, Succorance, Dominance, Abasement, Nurturance, Endurance, Heterosexuality, and Aggression.[3] The EPPS contains a consistency score, which proports to measure internal reliability, based on a student's answer to similar or identical questions.

Method of Data Treatment

The method of data treatment and of reporting its results utilized accepted scientific methods.

---

[1] Ibid., p. 11.

[2] Ibid., p. 19.

[3] Ibid., p. 22.

As considerable data lends itself well for statistical computation and analysis, linear regression, step-wise multiple regression, and Pearson Product-Moment correlations were applied, as applicable. Some data did not lend itself to statistical treatment; when encountered, such findings are stated in a verbally descriptive nature.

The major questions considered within the purpose of the study are stated within this section, with the proposed methods of data treatment.

QUESTION ONE: WHAT IS THE RELATIONSHIP BETWEEN ACHIEVEMENT AS DETERMINED BY GRADE WITHIN A MULTI-MEDIA LEARNING ENVIRONMENT AND SELECT PSYCHOLOGICAL AND ABILITY FACTORS OF THE INDIVIDUAL?

1. Data consists of the following measures of each student: term achievement scores and criterion measures included in the EPPS and GATB.
2. To determine the value of each of the twenty-four criterion measures in predicting academic success, Pearson Product-Moment correlations were calculated for each variable.
3. A further investigation was made to identify the manner by which low and high achievers differ with respect to each of the criterion factors.

A step-wise multiple regression was run on each of the twenty-four traits vs final grade in electronics to see how much interrelatedness existed. The hope was to determine the least number of variables which would provide the most amount of information towards prediction. To keep the number of variables within reason, the most

important five were used, as is customary with multiple regressions. The more variables considered the more interaction can take place and the less accurate a prediction can be made.

QUESTION TWO: WHAT IS THE RELATIONSHIP BETWEEN SELECT PSYCHOLOGICAL AND ABILITY FACTORS OF THE INDIVIDUAL AND THE CHOICE OF INSTRUCTIONAL MEDIA WHICH WAS PREFERRED BY THE LEARNER BASED ON HIS CHOICE?

1. Data available consists of EPPS and GATB scores and questionnaire returns.
2. Questionnaires were analyzed to answer the following items:
   (a) Which media are most frequently preferred and selected?
   (b) How do student ratings of the value of each type of media differ?
3. Pearson Product-Moment correlations were applied to determine which EPPS and GATB factors are most significantly related to learner selection of media types.
4. Traits of the individual were analyzed to determine their ability to differentiate between students who select predominantly verbal media (programmed and traditional texts) from those who prefer visual media (films and tape-slide presentations).

QUESTION THREE: WHAT IS THE LEARNERS ATTITUDE TOWARDS A MULTI-MEDIA INDIVIDUALIZED SELF-PACING PROGRAM OF STUDIES?

1. Tabulation of comments obtained from questionnaires administered to each student at the end of the quarter.
2. Teacher anecdotal records kept informally from time to time as students commented about operation and theory of the system.

QUESTION FOUR: ARE STUDENTS AWARE OF THEIR PERSONALITY AND APTITUDE TRAITS AND HOW TO UTILIZE THESE CHARACTERISTICS FOR STUDY PURPOSES?

1. Data obtained from personal interview with each student in the study.
2. Interpretation of data recorded from interview schedule as EPPS and GATB test results were explained to each student.
3. Tally of study check lists from each student.

QUESTION FIVE: IS THERE A PREDICTABILITY PATTERN FOR SELECT PERSONALITY AND APTITUDE TRAITS FOR HIGH AND LOW ACHIEVERS WHO HAVE EXPERIENCED A MULTI-MEDIA INDIVIDUALIZED PROGRAM OF STUDY?

1. Identification of high and low achievers by course grade.
2. Correlation of personality and ability traits with electronics course grade to identify differences between high and low achievers.
3. Breakdown of personality and ability traits vs grade on performance or manipulation (psychomotor domain) final to see if they differ from total group.
4. Breakdown of personality and ability traits vs grade on informational objective final (cognitive domain) to see if they differ from total group.

QUESTION SIX: WHAT ARE THE RECOMMENDATIONS FOR IMPROVEMENT FOR A MULTI-MEDIA INDIVIDUALIZED INSTRUCTION PROGRAM BASED ON THE RESULTS OBTAINED FROM THIS STUDY?

1. Teacher anecdotal records were examined to identify classroom conditions which were noted as being particularily effective or ineffective within the multi-media environment.

2. Student responses obtained from questionnaires administered at the end of the course regarding the quality of media and organization of the system.

CHAPTER IV

PRESENTATION OF DATA

The purpose of this study was to assess select learning outcomes within a multi-media environment as determined by data obtained within the multi-media environment consisting of seven classes in Beginning Electronics, IA 180, at the University of Northern Colorado.

The questions which structured this chapter were proposed in the purpose of the study. Analysis of data pertaining to each of the major questions will constitute the sections of this chapter.

The psychological and ability factors which are investigated here are those measured by the General Aptitude Test Battery (GATB) and the Edwards Personal Preference Schedule (EPPS). A description of each battery, with a description of its measured factors is included in Chapter III.

Part One--The Relationship Between Achievement in Basic Electronics as Determined by Grades Within a Multi-media Learning Environment and Select Psychological and Ability Factors of the Learner

This section will answer four questions which relate to achievement and select psychological and ability factors of the learner. These are (1) How did learners within a responsive environment in the basic electronics classes differ with respect to term achievement in the general college program? (2) How did high term achievers differ from

low term achievers in electronics with respect to each of the factors measured on the Edwards Personal Preference Schedule (EPPS) and the General Aptitude Test Battery (GATB)? (3) To what extent were each of the factors measured on the Edwards Personal Preference Schedule (EPPS) and General Aptitude Test Battery (GATB) intercorrelated or dependent on one another? (4) What factors or combination of factors from the Edwards Personal Preference Schedule (EPPS) and General Aptitude Test Battery (GATB) were best for predicting term achievement in beginning electronics in terms of course grade? Each of these questions will be treated separately within this section.

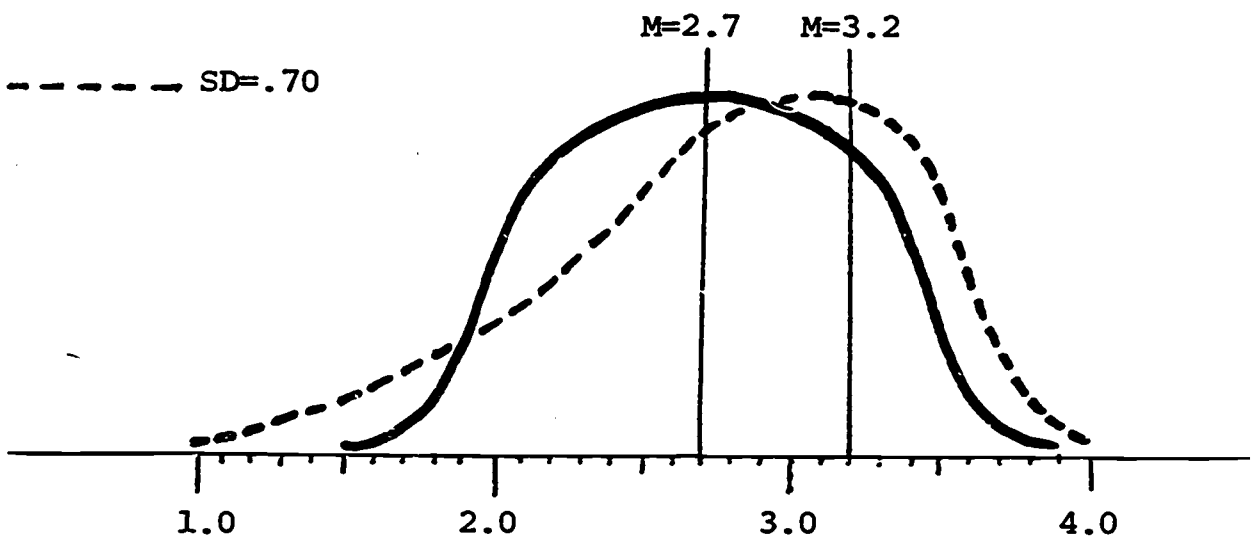
Question one: how did learners within a responsive environment in the basic electronics classes differ with respect to term achievement in the general college program?

During the quarters included in the study, objective and performance tests were administered. Each test was structured to measure student knowledge and skill related to the behavioral objectives listed in the Learning Activity Packets. All items contained on the objective final examination were contained in the self-tests of the activity packets. Therefore, no new test items were added for the final. Likewise, all tasks required for the final performance examination were outlined in a step-by-step procedure in the lab activities within the activity packet. Term achievement then, was calculated by determining how well the information and manipulative tasks were achieved at the end of the course. The emphasis between knowledge and skill was given an equal value or a 50-50 weight.

A frequency distribution of grades in the experimental electronics program vs previous grade point average of students enrolled is shown in Table 5.

TABLE 5

FREQUENCY DISTRIBUTION OF STUDENT SCHOOL GPA AND FINAL GRADES ASSIGNED IN THE EXPERIMENTAL ELECTRONICS PROGRAM
N=136



Electronics

Grade Min. 1.0
Max. 4.0

School

GPA Min. 1.5
Max. 3.9

Table 6 and 7 show the variations of school GPA vs information and GPA vs skill development. They are shown for comparison purposes only.

TABLE 6

FREQUENCY DISTRIBUTION OF STUDENT SCHOOL GPA AND OBJECTIVE FINAL GRADES ASSIGNED IN THE EXPERIMENTAL ELECTRONICS PROGRAM
N=89

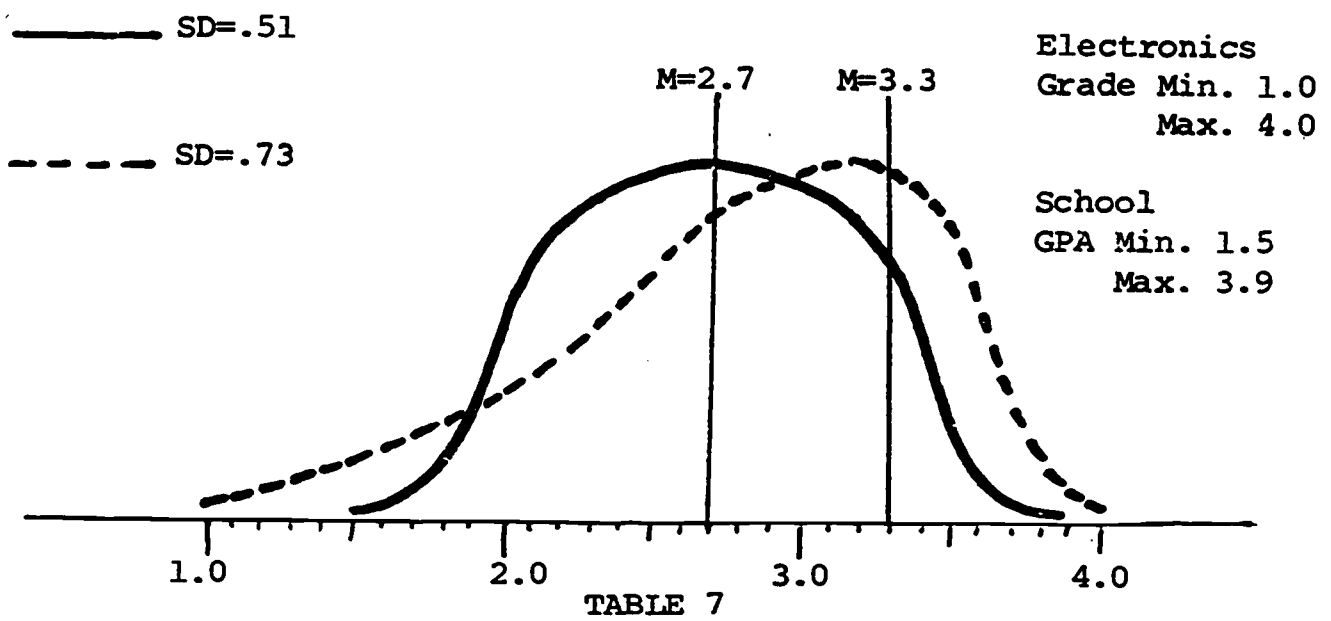
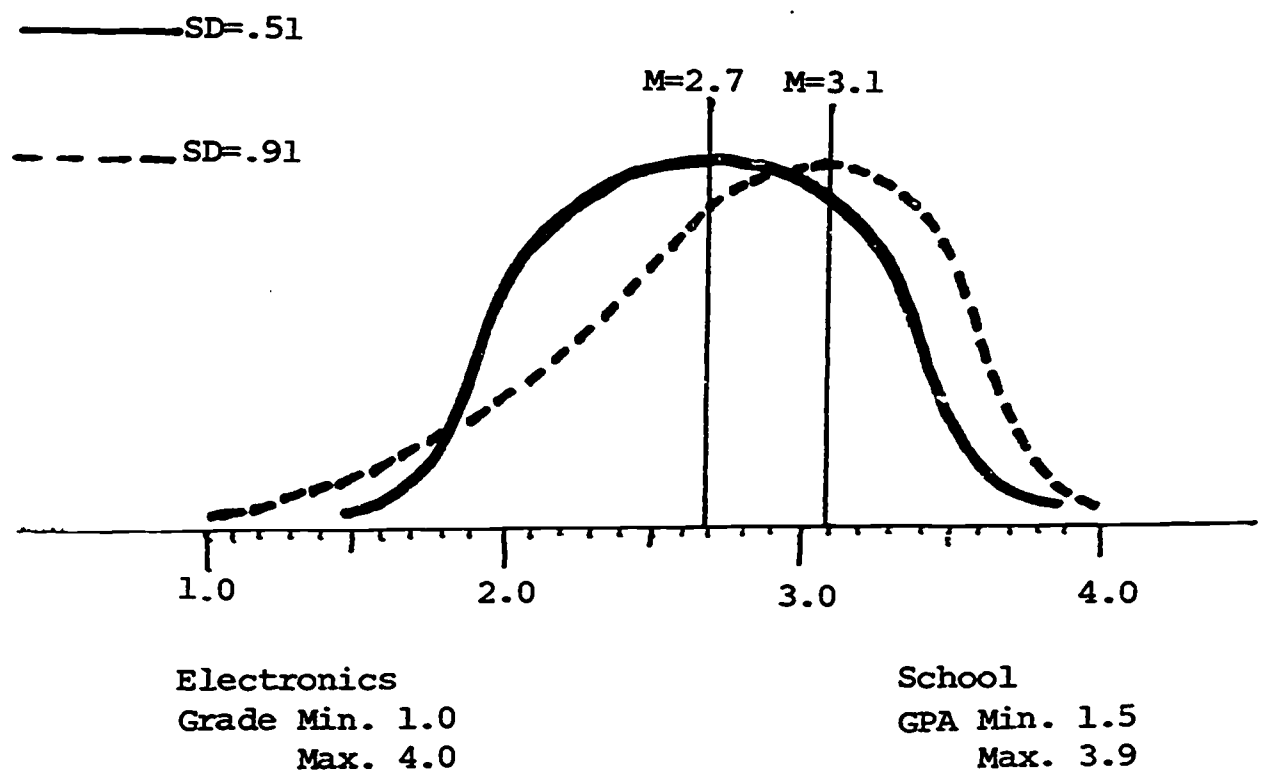


TABLE 7

FREQUENCY DISTRIBUTION OF STUDENT SCHOOL GPA AND PERFORMANCE (MANIPULATIVE) FINAL GRADES ASSIGNED IN THE EXPERIMENTAL ELECTRONICS PROGRAM
N=88



Question two: how did high term achievers differ from low term achievers in electronics with respect to each of the factors measured on the EPPS and GATB?

The purpose for investigating this question was to seek criterion which would be helpful in predicting learner success within a multi-media environment. Factors examined for predictive capability were those measured by the EPPS and the GATB.

The manner of treatment for this question was three-fold: (1) apply a Pearson Product-Moment correlation between each of the EPPS and GATB factors and term achievement, (2) apply a step-wise multiple regression to differentiate between the weight each factor common to low and high achievers, and (3) apply X^2 to further differentiate between those factors common to low and high achievers.

Table 8 presents Pearson Product-Moment correlations between term achievement and scores from each of the EPPS and GATB factors.

TABLE 8

CORRELATIONS BETWEEN FACTORS MEASURED BY THE EPPS-GATB TESTS AND TERM ACHIEVEMENT WITHIN A MULTI-MEDIA ENVIRONMENT

N=136

Factor	r
General Intelligence	.38*
Abasement	-.21*
Autonomy	-.19+
Affiliation	-.17+
Intraception	.10
Exhibition	-.16+
Dominance	.06
Motor Coordination	-.06
Clerical Perception	.27*
Deference	-.12
Succorance	-.18+
Form Perception	.19+
Nurturance	-.08
Heterosexuality	.06
Order	.03
Endurance	.08
Change	-.07
Finger Dexterity	.06
Numerical Aptitude	.24*
Spatial Aptitude	.27*
Achievement	.02
Verbal Aptitude	.31*
Aggression	-.05
Manual Dexterity	.01

*-Values of r significant at the 1% level = .201
+-Values of r significant at the 5% level = .159

Factors identified as being the most highly correlated with term achievement, in order of descending relationship are general intelligence, verbal aptitude, spatial aptitude, clerical perception, numerical aptitude, and abasement. These factors are positively correlated with the exception of abasement, which is negative. It should also be pointed out that all of the positively correlated factors come from the GATB. The level of significance is at the one percent level or higher which indicates that the ability to predict success or failure can be done rather consistently with the proper factors.

The second means of identifying select factors which differentiate high achievers from low achievers was to run a step-wise multiple regression equation of the EPPS-GATB traits against final grade in electronics class. The purpose here was to identify the highest five factors which give a reasonable prediction profile with all twenty-four variables considered. The factors most important and listed in descending order were; general intelligence, abasement, autonomy, affiliation and intraception. Of these five, general intelligence was found to contribute approximately five times more weight than any of the other variables listed based on the regression coefficient.

In order to refine further the values which might also be considered, a step-wise multiple regression was run with general intelligence deleted. In this run, the factors of verbal aptitude, spatial aptitude, autonomy, succorance and clerical perception were

identified in descending order, with spatial aptitude being the greatest contributer.

Because the GATB intelligence score is made of factors of numerical aptitude and spatial aptitude, a step-wise multiple regression was run with general intelligence, verbal aptitude and numerical aptitude deleted. The results of this run provided us with the five factors of spatial aptitude, clerical perception, autonomy, abasement and affiliation in descending order with spatial aptitude and clerical perception contributing twice as much to the prediction as the other values.

In summary, for this sample of data the best single predictor of success in an individualized program, based on grade point average, is general intelligence. The other factors that should be considered are abasement, autonomy, affiliation and intraception. With scores on intelligence and intraception high (50th percentile or above) and scores on abasement, autonomy and affiliation low (50th percentile or below) the ability to predict success or failure should be acceptable.

An effort was also made to look at the students who received an 'A' as a final course grade and compare their personality and aptitude characteristics against those who received grades of 'C' or 'D'. The comparison was made by looking at those students who received an 'A' grade and comparing the mean score of each of the twenty-four factors. A computation was then made by chi-square to determine the level at which a significant difference could be reported. The results of the comparison are shown in Table 9.

TABLE 9

COMPARISON OF ELECTRONIC CLASS GRADES RECEIVED AND MEAN SCORES ON EPPS AND GATB TESTS FOR HIGH AND LOW TERM ACHIEVERS

PERSONALITY TRAIT OR APTITUDE	ELECTRONICS GRADE	BELOW THE NORM N	%	ABOVE THE NORM N	%	CHI SQUARE	LEVEL OF SIGNIF.
GATB							
General Intelligence	C-D	15	68.2	7	31.8		
	A	14	31.8	30	68.2	7.87	(1%)
		29		37			
Verbal Aptitude	C-D	13	59.1	9	40.9		
	A	17	38.6	27	61.4	2.475	(20%)
		30		36			
Numerical Aptitude	C-D	11	50.0	11	50.0		
	A	16	36.4	28	63.6	1.13	
		27		39			
Spatial Aptitude	C-D	14	63.6	8	36.4		
	A	17	38.6	27	61.0	3.68	(10%)
		31		35			
Form Perception	C-D	16	72.7	6	27.3		
	A	19	43.2	25	56.8	5.14	(5%)
		35		31			
Clerical Perception	C-D	15	68.2	7	31.8		
	A	19	43.2	25	56.8	3.67	(10%)
		34		32			
Motor Coordination	C-D	11	50.0	11	50.0		
	A	25	56.8	19	43.2	.27	
		36		30			
Finger Dexterity	C-D	9	40.9	13	59.1		
	A	19	43.2	25	56.8	.03	
		28		38			
Manual Dexterity	C-D	13	59.1	9	40.9		
	A	26	59.1	18	40.9	.00	
		39		27			

TABLE 9 (cont.)

PERSONALITY TRAIT OR APTITUDE	ELECTRONICS GRADE	BELOW THE NORM N	BELOW THE NORM %	ABOVE THE NORM N	ABOVE THE NORM %	CHI SQUARE	LEVEL OF SIGNIF.
EPPS							
Achievement	C-D	11	50.0	11	50.0		
	A	22	50.0	22	50.0	.00	
		33		33			
Deference	C-D	8	36.4	14	63.6		
	A	28	63.6	16	36.4	4.40	(5%)
		36		30			
Order	C-D	11	50.0	11	50.0		
	A	24	54.5	20	45.5	.12	
		35		31			
Exhibition	C-D	10	45.5	12	54.5		
	A	27	61.4	17	38.6	1.51	
		37		29			
Autonomy	C-D	6	27.3	16	72.7		
	A	25	56.8	19	43.2	5.14	(5%)
		31		35			
Affiliation	C-D	9	40.9	13	59.1		
	A	23	52.3	21	47.7	.76	
		32		34			
Intraception	C-D	14	63.6	8	36.4		
	A	23	52.3	21	47.7	.77	
		37		29			
Succorance	C-D	7	31.8	15	68.2		
	A	24	54.5	20	45.5	3.04	(10%)
		31		35			
Dominance	C-D	17	77.3	5	22.7		
	A	27	61.4	17	38.6	1.67	
		44		22			
Abasement	C-D	9	40.9	13	59.1		
	A	31	70.5	13	29.5	5.36	(5%)
		40		26			

TABLE 9 (cont.)

PERSONALITY TRAIT OR APTITUDE	ELECTRONICS GRADE	BELOW THE NORM N	BELOW THE NORM %	ABOVE THE NORM N	ABOVE THE NORM %	CHI SQUARE	LEVEL OF SIGNIF.
EPPS (cont.)							
Nurturance	C-D	11	50.0	11	50.0		
	A	25	56.8	19	43.2	.27	
		36		30			
Change	C-D	10	45.5	12	54.5		
	A	24	54.5	20	45.5	.49	
		34		32			
Endurance	C-D	14	63.6	8	36.4		
	A	20	45.5	24	54.5	1.94	
		34		32			
Heterosexuality	C-D	13	59.1	9	40.9		
	A	21	47.7	23	52.3	.76	
		34		32			
Aggression	C-D	9	40.9	13	59.1		
	A	21	47.7	23	52.3	.28	
		30		36			

NOTE: There were a total of sixty-six students involved with this part of the study. Forty-four received A's; twenty-two received C's and D's.

The number of students used in this evaluation was sixty-six, forty-four of whom had received a grade of 'A' and twenty-two who received a grade of 'C'.

Reported in rank order from most to least significant are general intelligence, abasement, autonomy, form perception, deference, spatial aptitude, clerical perception, succorance, and verbal aptitude.

From this data, it can be stated that students who are in an individualized multi-media program in electronics are likely to score above the norm in general intelligence and form perception on the GATB and below the norm on EPPS in traits of autonomy, deference and abasement.

To allow some comparison between high, low, and average achievers, it is necessary to give the mean score generated by all of the 136 students who were involved in this part of the study for all traits evaluated. When a reference is made about a trait being above or below the mean, it is related to the mean score generated by this sample population, not the standard mean provided with the test. Comparison of standard means and the sample means, however, does not place the sample and standard means too far apart. Exceptions are general intelligence, spatial aptitude, and form perception.

In looking over the background of the students involved in the study, all were Industrial Arts major or minors. It is a requirement of the Industrial Arts program to have at least eleven quarter hours of drafting and design. As such, most students had at least one or more courses in drawing prior to enrolling in this class. This accounts for the increased mean in spatial aptitude and form perception.

The difference in general aptitude can be accounted for by the selection process of students in the university program. Only those who score above the mean on the American College Test or who graduated in the upper fifty-percentile of their high school class are admitted. Table 10 makes a comparison of the generated mean scores all traits involved on the GATB and EPPS tests against the standard mean scores. Also listed are the standard deviations for the generated mean score.

TABLE 10

MEAN SCORES OF GATB AND EPPS FACTORS GENERATED BY SAMPLE POPULATION IN THE STUDY

N=136

	PERSONALITY AND APTITUDE TRAIT	SAMPLE GENERATED MEANS	SAMPLE GENERATED STANDARD DEVIATION	GENERAL TEST STANDARD DEVIATION
	GATB			
1	General Intelligence	116.60	11.43	20.00+
2	Verbal Aptitude	106.74	12.74	20.00
3	Numerical Aptitude	110.49	10.96	20.00
4	Spatial Aptitude	126.53	15.86	20.00
5	Form Perception	119.98	15.49	20.00
6	Clerical Perception	112.89	17.21	20.00
7	Motor Coordination	106.42	17.87	20.00
8	Finger Dexterity	111.34	17.57	20.00
9	Manual Dexterity	113.97	19.19	20.00
	EPPS			
10	Achievement	45.74	27.06	15.66*
11	Deference	38.30	26.26	11.21
12	Order	47.62	30.37	10.23
13	Exhibition	46.21	29.86	14.40
14	Autonomy	49.83	29.08	14.34
15	Affiliation	39.86	27.90	15.00
16	Intraception	43.41	26.91	16.12
17	Succorance	48.60	29.07	10.74
18	Dominance	42.11	28.11	17.44
19	Abasement	49.30	30.41	12.74
20	Nurturance	48.80	31.38	14.04

TABLE 10 (cont.)

	PERSONALITY AND APTITUDE TRAIT	SAMPLE GENERATED MEANS	SAMPLE GENERATED STANDARD DEVIATION	GENERAL TEST STANDARD DEVIATION
	EPPS (cont.)			
21	Change	51.21	38.07	15.51
22	Endurance	54.24	28.36	12.66
23	Heterosexuality	50.88	29.50	17.65
24	Aggression	44.86	29.37	12.79

Standard GATB Mean = 100
Standard EPPS Mean = 50

* "Edwards Personal Preference Schedule," Revised Manual 1959. p. 10 College sample for men.

+ Standard Deviation for GATB is based on 4,000 persons in a stratified sample of the general working population. October, 1962. GATB users manual, section III, U.S. Dept. of Labor, p. 17.

Question three: to what extent are each of the factors measured on the EPPS and GATB intercorrelated?

Factors which are related to learning are seldom independently related. That is, some degree of dependency generally exists between such factors.

The Pearson Product-Moment is applicable for expressing dependencies among learning factors. Such dependencies are often termed intercorrelations, and are expressed in the term r. Total independence is indicated when r=0. Total dependence is indicated when r=1.

Intercorrelations between each combination of the EPPS and GATB factors are shown in Table 11.

The table indicates a relationship of dependency among predicter variables. Factors measured by the GATB items one through nine exhibit

greater intercorrelations than do EPPS factors. Several variables on either test however, are relatively independent in their measurement

TABLE 11

PEARSON PRODUCT-MOMENT INTERCORRELATIONS BETWEEN EPPS AND GATB FACTORS
N=136

	1	2	3	4	5	6	7	8
1	1.00	0.72*	0.72*	0.62*	0.41*	0.46*	0.10	0.21+
2		1.00	0.37*	0.24*	0.32*	0.36*	0.02	0.01
3			1.00	0.20*	0.37*	0.46*	0.10+	0.29*
4				1.00	0.31*	0.19+	0.01	0.15
5					1.00	0.36*	0.14	0.22+
6						1.00	0.21+	0.06
7							1.00	0.13
8								1.00

	9	10	11	12	13	14	15	16
1	0.10	0.01	-0.09	0.10	0.02	-0.12	-0.03	-0.09
2	-0.11	0.11	-0.09	-0.03	0.02	-0.04	-0.06	-0.08
3	0.20+	0.02	0.02	0.13	-0.01	-0.16	0.03	-0.13
4	0.11	-0.10	-0.13	0.03	0.00	-0.01	-0.07	0.07
5	0.17	0.01	-0.08	0.01	-0.03	0.08	-0.02	0.03
6	0.05	0.02	-0.08	0.02	-0.03	-0.01	-0.08	-0.06
7	0.34*	0.01	0.07	-0.04	-0.08	0.02	0.11	-0.06
8	0.50*	0.04	-0.00	0.12	-0.07	-0.04	0.02	-0.10
9	1.00	-0.18+	-0.03	0.01	-0.04	-0.04	-0.05	-0.10
10		1.00	0.07	0.23*	0.19+	-0.03	-0.14	-0.02
11			1.00	0.33*	0.04	-0.12	0.04	0.22*
12				1.00	-0.02	-0.00	-0.10	-0.03
13					1.00	0.24*	0.01	-0.11
14						1.00	-0.00	0.06
15							1.00	0.04
16								1.00

+ = 5% level of significance (.17)
* = 1% level of significance (.23)

TABLE 11

	17	18	19	20	21	22	23	24
1	-0.01	-0.05	-0.04	-0.02	-0.09	0.09	0.09	0.01
2	-0.03	0.02	-0.16	0.04	-0.06	0.04	0.13	0.07
3	0.05	-0.13	0.16	0.05	-0.02	0.17+	0.03	0.02
4	-0.01	-0.02	-0.16	-0.04	0.01	0.01	0.09	-0.06
5	-0.06	-0.06	0.01	0.10	0.06	0.15	0.05	-0.09
6	-0.10	-0.03	-0.12	-0.04	-0.02	0.09	0.03	0.01
7	0.06	0.02	0.02	-0.00	-0.03	0.04	-0.01	0.03
8	0.14	-0.02	-0.02	0.00	0.08	0.16	0.15	-0.04
9	-0.03	0.19+	0.03	-0.13	0.06	0.09	-0.02	0.06
10	0.14	0.12	0.03	0.00	-0.07	0.11	0.18+	0.20+
11	0.11	0.06	0.29*	0.08	-0.05	0.21+	-0.32*	-0.11
12	0.07	-0.06	0.19	-0.01	-0.11	0.40*	-0.06	0.11
13	0.25*	0.20+	0.06	-0.14	0.07	-0.05	0.14	0.18+
14	0.09	0.10	-0.09	-0.09	0.34*	-0.08	0.19+	0.36*
15	0.22+	-0.01	0.04	0.46*	0.13	-0.05	-0.01	-0.18+
16	-0.17+	0.12	-0.02	0.18	0.30*	0.12	-0.10	-0.18+
17	1.00	-0.04	0.16	0.24*	-0.03	-0.10	0.19	0.12
18		1.00	-0.06	-0.08	0.03	0.03	-0.01	0.19+
19			1.00	0.11	-0.11	0.22+	-0.11	0.03
20				1.00	0.07	0.09	-0.01	-0.26*
21					1.00	0.12	0.15	0.13
22						1.00	0.03	0.08
23							1.00	0.17+
24								1.00

+ = 5% level of significance (.17)
* = 1% level of significance (.23)

NUMBERS ASSIGNED TO PERSONALITY AND APTITUDE TRAITS

1	General Intelligence
2	Verbal Aptitude
3	Numerical Aptitude
4	Spatial Aptitude
5	Form Perception
6	Clerical Perception
7	Motor Coordination
8	Finger Dexterity
9	Manual Dexterity
10	Achievement
11	Deference
12	Order
13	Exhibition
14	Autonomy
15	Affiliation
16	Intraception
17	Succorance
18	Dominance
19	Abasement
20	Nurturance
21	Change
22	Endurance
23	Heterosexuality
24	Aggression

Question four: what factors or combination of factors from the Edwards Personal Preference Schedule (EPPS) and the General Aptitude Test Battery (GATB) were best for predicting term achievement in beginning electronics in terms of course grade?

To answer this question, information from several tables was used. The highest correlation between term achievement and the aptitude factors in descending order were: general intelligence, verbal aptitude, spatial aptitude, clerical perception, and numerical aptitude. These factors were positive when compared to success in term achievement and were significant at the one percent level of confidence.

The highest correlation between term achievement and the personality factors in descending order were: abasement, autonomy, succorance, affiliation, and exhibition. These factors were negative when compared to success in term achievement and were significant at the five percent level of significance. Only abasement was significant at the one percent level of confidence.

The EPPS and GATB factors which are most reliable for making predictions of successful term achievement are: general intelligence, abasement, autonomy, affiliation and intraception. With high scores (50 percentile or above) in general intelligence and intraception and low scores (50 percentile or below) in abasement, autonomy and affiliation, it is possible to expect a grade of 'A' or 'B' 95 times out of 100. From this information a success profile can be developed and used by the teacher in classroom decision making.

A failure profile is also capable of being developed. Low values in general intelligence and intraception and high scores in abasement, autonomy and affiliation would indicate problems in learning in an individualized, multi-media program.

Because each individual's profile is somewhat different, the teacher should look at the scores on the positive and negative factors from EPPS and GATB tests. Common sense will dictate the strength to be given any one profile for predicting success or failure. Generally, the more closely a profile reaches the 'ideal' the greater the chances of success or failure are likely to be.

Part Two--The Relationship between Achievement in Basic Electronics, the Selection of Media, and Select Psychological and Ability Factors of the Learner

Question one: what was the relative frequency of selection of each type of media available for high term achievers?

For purposes of this comparison, students who received grades of 'A' were considered as high achievers and those who received 'C' and 'D' were low achievers. As frequency of choice was the main concern, a tabulation was made of the most often to least often media selected. Table 12 shows the results of the compilation.

Further study and analysis of Table 12 will indicate that each of the six media, films, programs, tape-slides, teacher lectures, lab activities and texts were chosen first by some of the students. The main purpose of media breakdown is to determine approximately what

percentage of the 'A' students who chose films first also used the other media and in what sequence. As indicated, the split is about equal of those who used films first, which means that several other media were used by these same students and preference was not critical.

Another observation will show that regardless of the 1st choice of media picked, all were used by at least a few students. It should be noted, however, that any one student did not use all six of the media for any given lesson. The choices were based on a selection and/or preference.

TABLE 12

FREQUENCY OF MEDIA SELECTION BY HIGH TERM ACHIEVERS WHO RECEIVED GRADES OF 'A' IN ELECTRONICS
N=44

MEDIA SELECTED AS 1st CHOICE	PERCENT OF STUDENTS	MEDIA
FILMS	15.9	Films
	15.9	Programs
	15.9	Tape-Slides
	13.6	Teacher Lectures
	6.8	Lab Activity
	15.9	Text
	15.9	No Choice
PROGRAMS	2.3	Films
	9.1	Programs
	15.9	Tape-Slides
	11.4	Teacher Lectures
	25.0	Lab Activity
	20.5	Text
	15.9	No Choice

TABLE 12 (cont.)

MEDIA SELECTED AS 1st CHOICE	PERCENT OF STUDENTS	MEDIA
TAPE-SLIDES	15.9	Films
	18.2	Programs
	15.9	Tape-Slides
	15.9	Teacher Lectures
	6.8	Lab Activity
	11.4	Text
	15.9	No Choice
TEACHER LECTURES	13.6	Films
	9.1	Programs
	18.2	Tape-Slides
	9.1	Teacher Lectures
	18.2	Lab Activity
	15.9	Text
	15.9	No Choice
LAB ACTIVITY	15.9	Films
	20.5	Programs
	15.9	Tape-Slides
	18.2	Teacher Lectures
	9.1	Lab Activity
	4.5	Text
	15.9	No Choice
TRADITIONAL TEXT	20.5	Films
	11.4	Programs
	2.3	Tape-Slides
	15.9	Teacher Lectures
	18.2	Lab Activity
	15.9	Text
	15.9	No Choice

In general, the findings show that of those who chose programs as their first preference, films were given little use. Also of those who chose the text as first choice, more used the films and lab activity than the other media. Basically, selection of given media to initiate study for the 'A' student is not critical and success can be achieved with any media.

Question two: what was the relative frequency of selection of each type of media available for low term achievers?

The low term achiever was identified by grades of 'C' or 'D' in electronics. As in processing the high term achiever, an analysis was made of first choice of media use. This data is shown in Table 13.

The students who used films as 1st choice also used tape-slide presentations. Of those who chose the traditional text or lab activity as 1st choice almost 1/3 saw a film also. The trend seemed to be with the low achiever to use the tape-slide to supplement the film, the text to supplement the program, the film to supplement the lab activity and to rely on the teacher lecture as initial contact with the material. As in the high achiever group, the selection of first choice media was not critical but an emphasis was on the verbal rather than the visual mode.

TABLE 13

FREQUENCY OF MEDIA SELECTION BY LOW TERM ACHIEVERS
WHO RECEIVED GRADES OF 'C' OR 'D' IN ELECTRONICS
N=22

MEDIA SELECTED AS 1st CHOICE	PERCENT OF STUDENTS	MEDIA
FILMS	4.8	Films
	9.5	Programs
	38.1	Tape-Slides
	19.0	Teacher Lectures
	14.3	Lab Activity
	9.5	Text
	4.8	No Choice
PROGRAMS	4.8	Films
	19.0	Programs
	14.3	Tape-Slides
	14.3	Teacher Lectures
	28.6	Text
	4.8	No Choice

TABLE 13 (cont.)

MEDIA SELECTED AS 1st CHOICE	PERCENT OF STUDENTS	MEDIA
	4.8	Films
	14.3	Programs
	9.5	Tape-Slides
TAPE-SLIDES	14.3	Teacher Lectures
	38.1	Lab Activity
	14.3	Text
	4.8	No Choice
	19.0	Films
	19.0	Programs
	4.8	Tape-Slides
TEACHER LECTURES	28.6	Teacher Lectures
	19.0	Lab Activity
	4.8	Text
	4.8	No Choice
	33.3	Films
	23.8	Programs
	9.5	Tape-Slides
LAB ACTIVITY	4.8	Teacher Lectures
	4.8	Lab Activity
	19.0	Text
	4.8	No Choice
	28.6	Films
	9.5	Programs
	19.0	Tape-Slides
TRADITIONAL TEXT	14.3	Teacher Lectures
	4.8	Lab Activity
	19.0	Text
	4.8	No Choice

Question three: which sequence of media use appeared for the high and low term achiever?

An analysis of media usage by the high and low term achievers is given in Tables 14 through 19. Table 14 lists the usage of films in sequence of selection. Each of the other media were checked for sequency of use by both high and low achievers. To give added comparison, the 'B' students and their sequence of use is also provided.

TABLE 14

SEQUENCE OF USE FOR FILMS BY THE HIGH AND LOW TERM ACHIEVERS IN ELECTRONICS
N=66

SEQUENCE OF USE	HIGH TERM ACHIEVEMENT NUMBER OF 'A' STUDENTS	PER-CENT	LOW TERM ACHIEVEMENT NUMBER OF C-D STUDENTS	PER-CENT	AVERAGE ACHIEVEMENT NUMBER OF 'B' STUDENTS	PER-CENT
1st	7	15.9	1	4.5	15	21.4
2nd	6	13.6	3	13.6	6	8.6
3rd	7	15.9	8	36.4	12	17.1
4th	6	13.6	4	18.2	10	14.3
5th	4	9.1	3	13.6	8	11.4
6th	7	15.9	2	9.1	10	14.3
No Choice	7	15.9	1	4.5	9	12.9
	44	100.0	22	100.0	70	100.0

TABLE 15

SEQUENCE OF USE FOR PROGRAMMED MATERIALS FOR HIGH AND LOW TERM ACHIEVER IN ELECTRONICS
N=66

SEQUENCE OF USE	HIGH TERM ACHIEVEMENT NUMBER 'A' STUDENTS	PER-CENT	LOW TERM ACHIEVEMENT NUMBER C-D STUDENTS	PER-CENT	AVERAGE ACHIEVEMENT NUMBER OF 'B' STUDENTS	PER-CENT
1st	1	2.3	1	4.5	3	11.4
2nd	4	9.1	4	18.2	13	18.6
3rd	7	15.9	3	13.6	6	8.6
4th	4	9.1	3	13.6	9	12.9
5th	11	25.0	4	18.2	12	17.1
6th	10	22.7	6	27.3	18	25.0
No Choice	7	15.9	1	4.5	9	12.9
	44	100.0	22	100.0	70	100.0

TABLE 16

SEQUENCE OF USE FOR TAPE-SLIDE MATERIALS FOR HIGH AND LOW TERM ACHIEVERS IN ELECTRONICS
N=66

SEQUENCE OF USE	HIGH TERM ACHIEVEMENT NUMBER OF 'A' STUDENTS	PER-CENT	LOW TERM ACHIEVEMENT NUMBER OF C-D STUDENTS	PER-CENT	AVERAGE ACHIEVEMENT NUMBER OF 'B' STUDENTS	PER-CENT
1st	7	15.9	1	4.5	8	11.4
2nd	9	20.5	3	13.6	14	20.0
3rd	7	15.9	2	9.1	9	12.9
4th	7	15.9	3	13.6	10	14.3
5th	2	4.5	8	36.4	12	17.1
6th	5	11.4	4	18.2	7	10.0
No Choice	7	15.9	1	4.5	10	14.3
	44	100.0	22	100.0	70	100.0

TABLE 17

SEQUENCE OF USE FOR TEACHER LECTURE FOR HIGH AND LOW TERM ACHIEVERS IN ELECTRONICS
N=66

SEQUENCE OF USE	HIGH TERM ACHIEVEMENT NUMBER OF 'A' STUDENTS	PER-CENT	LOW TERM ACHIEVEMENT NUMBER OF C-D STUDENTS	PER-CENT	AVERAGE ACHIEVEMENT NUMBER OF 'B' STUDENTS	PER-CENT
1st	7	15.9	5	22.7	7	10.0
2nd	4	9.1	4	18.2	5	7.1
3rd	8	18.2	1	4.5	13	18.6
4th	4	9.1	6	27.3	16	22.9
5th	8	18.2	4	18.2	11	15.6
6th	6	13.6	1	4.5	8	11.4
No Choice	7	15.9	1	4.5	10	14.3
	44	100.0	22	100.0	70	100.0

TABLE 18

SEQUENCE OF USE FOR LAB ACTIVITIES FOR HIGH AND LOW TERM ACHIEVERS IN ELECTRONICS
N=66

SEQUENCE OF USE	HIGH TERM ACHIEVEMENT NUMBER OF 'A' STUDENTS	PER-CENT	LOW TERM ACHIEVEMENT NUMBER OF C-D STUDENTS	PER-CENT	AVERAGE ACHIEVEMENT NUMBER OF 'B' STUDENTS	PER-CENT
1st	7	15.9	7	31.8	16	22.9
2nd	9	20.5	5	22.7	12	17.1
3rd	6	13.6	3	13.6	10	14.3
4th	9	20.5	1	4.5	13	18.6
5th	4	9.1	1	4.5	9	12.9
6th	2	4.5	4	18.2	1	1.4
No Choice	7	15.9	1	4.5	9	12.9
	44	100.0	22	100.0	70	100.0

TABLE 19

SEQUENCE OF USE FOR TRADITIONAL TEXTS FOR HIGH AND LOW TERM ACHIEVERS IN ELECTRONICS
N=66

SEQUENCE OF USE	HIGH TERM ACHIEVEMENT NUMBER OF 'A' STUDENTS	PER-CENT	LOW TERM ACHIEVEMENT NUMBER OF C-D STUDENTS	PER-CENT	AVERAGE ACHIEVEMENT NUMBER OF 'B' STUDENTS	PER-CENT
1st	8	18.2	6	27.3	12	17.1
2nd	5	11.4	2	9.1	11	15.7
3rd	2	4.5	4	18.2	11	15.7
4th	7	15.9	4	18.2	3	4.3
5th	8	18.2	1	4.5	8	11.4
6th	7	15.9	4	18.2	16	22.9
No Choice	7	15.9	1	4.5	9	12.9
	44	100.0	22	100.0	70	100.0

A general evaluation of Tables 14 through 19 on sequence of media usage, nets the following data. The lab activities, teacher lectures and tape-slides are used more often by both high and low achievers than the other media. Low term achievers use the tape-slides, as a supplemental media while high term achievers prefer them for initial contact. Both high and low term achievers use programmed materials as a supplement to rather than an initial contact for electronics information. Both chose the use of films as a supplemental media with preference being 2nd, 3rd, or 4th in frequency, lab activities are preferred by both the high and low achiever as an initial contact or early supplemental media while texts are used at any level of sequence, with the high term achiever preferring them either first or last.

In short a high term achiever in electronics used the film, tape-slide, text or teacher lecture as an initial contact followed by the lab activity. To summarize his experiences he then used the programmed materials.

Question four: which EPPS and GATB factors were most significantly related to learner selection of media types?

A correlation was run between media types (verbal vs visual) and the aptitude-personality traits of the students. Only three traits were identified as significant at the 10 percent level of confidence when related to media choice. Students who had high scores in endurance tended to choose visual media which were the 16mm films and the tape-slide presentations. Students who had high scores in affiliation and

intraception preferred the verbal media which were traditional textbooks and programmed materials. For sake of comparison, students who chose lab activities and teacher lecture as their first choice were not considered in this comparison as the difference between verbal versus visual was the problem.

Table 20 shows the relationship of the personality and aptitude traits and media choice. High negative correlations show a preference for visual media whereas high positive scores show a preference for visual media whereas high positive scores show a preference for verbal media. A number of traits were close to being significant but no value was reached from a numerical point of view. Change was close for visual media exhibition and abasement being close for verbal media.

TABLE 20

EPPS AND GATB FACTORS CORRELATED TO THE SELECTION OF VERBAL OR VISUAL MEDIA
N=70

PERSONALITY AND APTITUDE TRAIT	CORRELATION r
GATB	
General Intelligence	.05
Verbal Aptitude	.01
Numerical Aptitude	.08
Spatial Aptitude	-.03
Form Perception	-.00
Clerical Perception	-.06
Motor Coordination	-.06
Finger Dexterity	-.12
Manual Dexterity	.08

TABLE 20 (cont.)

PERSONALITY AND APTITUDE TRAIT	CORRELATION r
EPPS	
Achievement	.01
Deference	.08
Order	.96
Exhibition	.18
Autonomy	.04
Affiliation	-.20+
Intraception	-.24+
Succorance	.00
Dominance	.09
Abasement	.15
Nurturance	.03
Change	-.17
Endurance	-.21+
Heterosexuality	.07
Aggression	.00

Positive values of 'r' show a preference for verbal media.
Negative values of 'r' show a preference for visual media.

* - 5 percent level of significance = .235
+ - 10 percnet level of significance = .197

Question five: how did learners who selected verbal media as first preference differ from those who selected visual media as first choice?

Students who selected verbal media as first choice exhibited a high need for doing and sharing things with friends and trying to understand how others feel about problems. They have a tendency to judge people by why they do things rather than by what they do. In some instances they exhibited a high need to be the center of attention as well as a strong feeling of guilt when doing something wrong.

Students who selected the visual media exhibited a strong need to keep at a job until it is finished, to complete any job undertaken, to work hard at a task and not to accept other jobs until one is

finished. In most cases they had a need to do new and different things, to experiment and try new things and to experience novelty.

Question six: what types of students profited most from a multi-media, individualized, self-pacing program of studies? Which profited least as determined by hign-low achievers in electronics versus grade point average?

A correlation between preference of media and final grade in electronics was made to identify, if any, the specific traits that might help teachers locate students who would have trouble in a multi-media environment or to find those types of students who would likely be successful. The level of significance was .16, well below the .25 required at the 10 percent level. It seems possible that with more valid test scores and a greater number of students, a stronger relationship might be developed between grade point and media selection or preference. For this study, no conclusion can be reached as no clear means of student identification for high and low achievers was possible by student types.

A correlation was run between the final grades assigned in electronics and the personality-aptitude traits of the students to further identify those traits that might help predict a successful student. Likewise, a profile for the problem student might further be refined. Table 21 shows the correlations between the personality and aptitude traits of the students related to their final grade in electronics. A high grade in electronics and a high score on the traits gives a positive value. High grades in electronics and a low score on the traits gives a negative value. By looking at the table, it is possible

to build a profile for those students who were successful and judge the level of score you would expect on the personality and aptitude tests.

TABLE 21

CORRELATION BETWEEN FINAL ELECTRONICS GRADE AND TRAITS OF APTITUDE AND PERSONALITY
N=136

PERSONALITY AND APTITUDE TRAIT	CORRELATION r
GATB	
General Intelligence	.38*
Verbal Aptitude	.31*
Numerical Aptitude	.24*
Spatial Aptitude	.27*
Form Perception	.19+
Clerical Perception	.27*
Motor Coordination	-.06
Finger Dexterity	.06
Manual Dexterity	.01
EPPS	
Achievement	.02
Deference	-.12
Order	-.03
Exhibition	-.16
Autonomy	-.19+
Affiliation	-.17+
Intraception	.10
Succorance	-.18+
Dominance	.06
Abasement	-.21+
Nurturance	-.08
Change	-.07
Endurance	.08
Heterosexuality	.06
Aggression	-.05
School Grade Point Average	.46*

+ - 5 percent level of confidence = .174
* - 1 percent level of confidence = .228

The best predictors of success in electronics from the GATB are general intelligence, verbal aptitude, numerical aptitude, and spatial aptitude, all at the 1 percent level of significance. Personality variables which are usable for predicting success are autonomy, affiliation, succorance, and abasement, all of which are significant at the 5 percent level of confidence. As expected, the correlation between school GPA and final electronics grade was very high, .46.

Question seven: which personality and aptitude traits were best for predicting manipulative achievement or psychomotor skill development?

To answer this question a correlation was run between the scores on the EPPS and GATB tests against the grades assigned for the performance test in the electronics classes. High scores on the EPPS-GATB tests and high grades earned on the performance test yield a positive value. Low grades on the EPPS-GATB tests and high grades on the performance test yield a negative value. Table 22 shows the generated correlations obtained by processing the scores and assigned grades.

Only general intelligence and numerical aptitude were significant at the 5 percent level of confidence. Scores on verbal aptitude and dominance were close and should be given some consideration although not numerically significant. As expected, the value between the objective test and the performance test was significant at the 1 percent level with an 'r' of .28.

TABLE 22

CORRELATION BETWEEN PERSONALITY AND APTITUDE TRAITS AND MANIPULATIVE OR PERFORMANCE TEST GRADES ASSIGNED TO ELECTRONICS STUDENTS
N=136

PERSONALITY AND APTITUDE TRAIT	CORRELATION r
GATB	
General Intelligence	.23+
Verbal Aptitude	.14
Numerical Aptitude	.21+
Spatial Aptitude	.07
Form Perception	.10
Clerical Perception	.09
Motor Coordination	.07
Finger Dexterity	.03
Manual Dexterity	.13
EPPS	
Achievement	.02
Deference	-.09
Order	-.04
Exhibition	-.09
Autonomy	-.10
Affiliation	.10
Intraception	.11
Succorance	.03
Dominance	.19
Abasement	.04
Nurturance	.02
Change	-.12
Endurance	.02
Heterosexuality	-.05
Aggression	-.02
Grade on objective test	.28*

+ - 5% level of significance = .211
* - 1% level of significance = .275

Question eight: which personality and aptitude traits were best for predicting informational or cognitive achievement in electronics?

As was done with the manipulative test results, a correlation was run between the GATB and EPPS scores and the final grade assigned to the objective or cognitive test. As shown in Table 23, the factors

TABLE 23

CORRELATION BETWEEN PERSONALITY AND APTITUDE TRAITS AND INFORMATIONAL COGNITIVE TEST GRADES ASSIGNED TO ELECTRONICS STV1 N=136

PERSONALITY AND APTITUDE TRAIT	CORRELATION r
GATB	
General Intelligence	.30*
Verbal Aptitude	.23+
Numerical Aptitude	.36*
Spatial Aptitude	.10
Form Perception	.15
Clerical Perception	.29*
Motor Coordination	-.04
Finger Dexterity	.05
Manual Dexterity	.03
EPPS	
Achievement	.09
Deference	.03
Order	.02
Exhibition	-.18
Autonomy	-.15
Affiliation	.07
Intraception	.07
Succorance	-.09
Dominance	-.10
Abasement	-.15
Nurturance	.16
Change	-.02
Endurance	.00
Heterosexuality	.17
Aggression	-.10
Grade on performance test	.28*

+ - 5% level of significance - .211
* - 1% level of significance = .275

of general intelligence, numerical aptitude and clerical perception are significant at the 1 percent level of confidence. The factor of verbal aptitude was significant at the 5 percent level with exhibition being nearly so.

The negative correlations show a low score on the personality and aptitude traits and a high grade on the cognitive test, a positive correlation shows a high score on both the trait and the cognitive test. It would appear in looking at both the GATB and EPPS factors, that the GATB is very useful for making predictions related to success and failure in electronics with the EPPS being used to support or add strength to the prediction.

Part Three--Attitude of Learners Toward Multi-Media, Individualized, Self-pacing Program at UNC.

Question one: what was the learner's attitude toward a multi-media, individualized, self-pacing program of studies? Should it be continued in the electronics program at the University of Northern Colorado and in other classes?

To evaluate the attitude of the Learner Controlled Education system from the attitudes of students, the following three questions were asked.

1. Do you like the individualized, multi-media self-pacing instruction system?

Yes	No	No Opinion	Total
111	14	11	136

2. Would you recommend its continuance in the electronics lab at UNC?

Yes	No	No Opinion	Total
116	12	8	136

3. Would you recommend the system to be used in other classes on campus?

Yes	No	No Opinion	Total
80	30	26	136

Based on answers to the previous questions the students did like the system and recommended its continuance in electronics. However, a few were skeptical about its effectiveness in other areas or courses in the college program. A number were unwilling to commit themselves at the time totally to such a system, although they did prefer it for electronics instruction.

Question two: were students knowledgeable of their learning assets and liabilities prior to the experience in this class? Had they been formally taught how to study?

The information on this item was obtained in the interview conducted by the teacher with each student. Of the 193 people enrolled in the courses initially, 140 said that at no time had they been formally taught how to study. Some indicated that they had read some information on their own and had followed the suggestions given but had not spent much time thinking about it. Fifty-three said that they had taken the GATB or EPPS previously and had one or the other briefly interpreted to them. However, it was not done to help them set up a pattern of study or to help improve the learning process. As a general rule, the students had an idea of how they felt about the relationships with others, but had not been confronted with test results of the kind used in this study. The concensus was that the EPPS test did a fairly good job of identifying how they really felt.

Question three: did the Learner Controlled Education System create a change in attitude regarding the learning process?

An opportunity was provided on the critique at the end of the classes for students to comment on their attitude about the system. The majority of students viewed the LCE system in a positive manner, agreeing that it contained more advantages than disadvantages. The prime advantage listed was the opportunity of the student to see exactly what he was to do, under what conditions and to what level of proficiency. Also the opportunity to proceed at a self-determined pace using a multi-media environment to achieve it.

Several comments were made relating to the fairness of the tests and the usability and helpfulness of the self-tests in the packets. As the tests were designed to measure only the stated objectives, the non-individualized or group instruction programs can profit from these results by seeking to clarify student objectives to assure learner familiarization with expectation.

Most of the students indicated that the system did in effect cut down on the anxiety level of the student regarding learning, although a few said it increased their frustration. A number of students said their initial contact of the system was one of fear but that as time elapsed they found their anxiety being diminished as decisions were made within the program. A feeling was expressed by several students that "We want to make our own decisions, but we're not sure we can make the right one." Experience with the LCE System provided them with the confidence they needed to make valid and wise decisions on how to learn.

Part Four--What Recommendations for Improvement were made for the present "Learner Controlled Education" Program in Electronics at the University of Northern Colorado?

Table 24 is a breakdown of the comments made by students for improving the Learner Controlled Education program. Although all 136 students were given an opportunity to comment only a few did. Several students made two or more comments. In general, the system was accepted favorably and thought very useful by a majority of the students. The greatest concern seemed to be related to the quality of the media available. This is understandable, as the films, tape-slides, etc. were

adapted from other programs and in the main not specifically designed for this program.

Other suggestions from the students had to do with the lack of motivation it presented to the student and a need for more teacher contact in the classroom.

TABLE 24

RECOMMENDATIONS TO IMPROVE THE LEARNER CONTROLLED EDUCATION SYSTEM IN ELECTRONICS
N=136

COMMENT	NUMBER OF STUDENTS
Better quality media	29
Everything OK	21
More lecture by teacher	18
More media sources	15
Lack of motivation	10
Orientation of packets by teacher	9
More contact with instructor	8
More demonstrations	5
Review of packets by instructor	4
Fewer media sources	3
Redistribution of lab periods	1
Materials available only in lab	1
Mandatory attendance	1

Part Five--Comparison to the Harmon Pilot Study

One of the purposes of this study was to validate the predictors identified by Harmon in the pilot study. Much of the data treatment used by Harmon is replicated in this study to allow comparisons to be made. Initially, it was questionable if levels of significance could be determined in Harmon's study with much accuracy as only thirty-four students

were used. By combining the original thirty-four in this study and increasing the number of students to 196 greater reliability could be placed on the predictors identified.

To show this reliability, an R^2 was run between the highest four predictor values assigned by Harmon's study and the highest four predictors identified by this study. As shown in Table 25, the Z weights are much higher for this study than for Harmon's study. In essence, this allows the teacher a greater confidence in making prediction. In general, the increased reliability is probably due to increased number of students in the study.

TABLE 25

COMPARISON OF RELIABILITY FOR PREDICTORS IDENTIFIED IN HARMON'S STUDY AGAINST THOSE ISOLATED BY JELDEN.

HARMON'S STUDY
N=34

RANK ORDER	VARIABLE	Z WEIGHT	R^2
1	Spatial Aptitude	.2736	
2	Change	-.0653	
3	Dominance	.0642	
4	Nurturance	-.0621	.0881

JELDEN'S STUDY
N=136

RANK ORDER	VARIABLE	Z WEIGHT	R^2
1	General Intelligence	.3427	
2	Abasement	-.2041	
3	Autonomy	-.1741	
4	Affiliation	-.1416	.2290

It is interesting to compare the similarities and differences identified by both studies. Note that in Harmon's study, spatial aptitude was the GATB factor used as the best predictor and in Jelden's study, it

was general intelligence. As part of the general intelligence score is generated by the spatial aptitude, there is a positive relationship and for comparison purposes, the studies compliment each other at this point. However, the EPPS factors of dominance, nurturance and change identified by Harmon do not appear as the EPPS factors identified by Jelden, which were autonomy, affiliation and abasement. By making a comparison between the two studies, different personality profiles emerge. Harmon's student had a low need for change and was a more unsympathetic person who wanted to be a leader while Jelden's student was a person who had a need to conform and would rather work independently to promote a feeling of superiority rather than work with friends and who had low guilt feelings.

Basically, from the data available it is very difficult to predict academic success and failure based on a personality profile. Much greater success can be made by predicting on aptitudes or ability factors. In fact, by comparing the Z Weights of the GATB and the EPPS, a relative success value, for purposes of prediction, from two to four times is possible with the GATB as compared with the EPPS.

CHAPTER V

SUMMARY, CONCLUSIONS, IMPLICATIONS, AND RECOMMENDATIONS

Summary.

The purpose of this study was to investigate the effectiveness of predicting success and/or failure in an individualized, multi-media learning environment. More specifically, the study attempted to answer questions related to the following four areas. These are (1) the relationship between achievement in basic electronics as determined by grades within a multi-media learning environment and select psychological and ability factors of the learner, (2) the relationship between achievement in basic electronics and selection of media and select psychological and ability factors of the learner, (3) the attitude of learners toward multi-media, individualized, self-pacing program at UNC, and (4) what recommendations for improvement were made to the present Learner Controlled Education program in the electronics lab at the University of Northern Colorado. Also, an attempt was made to compare the outcome of the pilot study done by Dr. James Harmon in 1969 with the results of this particular study.

The following limitations were noted in the application of this study:

1. Only those students who enrolled in a basic course in electricity, IA 180 each quarter from spring, 1969, through the spring of 1971, were included.

2. Only those students who indicated by a pre-test or interview that they had less than a ten-week introductory course in electricity or electronics.
3. Only those students who carried no less than nine quarter hours, and no more than eighteen quarter hours of course work during the class participation in the study.
4. The individual class size was limited to no less than fifteen students, and no more than thirty-five students.
5. Only those students who had scores on both the General Aptitude Test Battery and the Edwards Personal Preference Schedule and who completed the requirements of the course with an assigend grade were included.
6. The instructional media which included accelerated and initial contact programs, 16mm black and white accelerated and initial contact films, 35mm tape-slide presentations, teacher lectures, laboratory activities as outlined in the activity packets designed for the course, and a traditional textbook, Hileaf's Electricity 1-7, published by the Haden Book Company, Inc.

The original number of students included in the study was 193, 136 of which met all the criteria as listed in the limitations of the study. Of these 136 students, 44 received grades of 'A', 70 received grades of 'B', 21 received grades of 'C', and 1 received grade of 'D'. For sake of identification and comparison, those who received A's were considered high achievers, those who received grades of C and D were considered low achievers.

A thorough search of related literature found no studies exactly like this one, with the exception of Harmon's pilot study of 1969, entitled, "Effects of a Multi-media Environment in College Level Electronics," done at the University of Northern Colorado, Industrial Arts Department, Greeley, Colorado.

Measures of psychological and ability factors of the learner which were examined within this study were those included within the Edwards Personal Preference Schedule and the General Aptitude Test Battery. Twenty-four such factors were examined and compared with general grade point average established by the student at the University of Northern Colorado. A performance test which was given at the end of the class, an objective informational test at the end of the class, and a final grade, which was a combination of both final objective and performance tests.

Available data was that of the GATB and EPPS test scores, informational and performance tests, personal interviews, teacher anecdotal records, and answers to student questionnaires. Treatment of the data was primarily statistical, which included use of the step-wise multiple regression, linear regression, Pearson Product-Moment Correlations and Chi^2.

Findings, Conclusions, and Implications

Analysis of data obtained within this study has yielded the following information:

1. Term achievement within the multi-media individualized self-pacing environment exhibited a large heterogeniety of

variance. The nature of its positively skewed distribution differed markedly from that of the normal curve, suggesting that media as a sole means of instruction may not be suited for all learners, but works well for most. The general results, however indicate that students in a multi-media individualized environment achieved at a higher level than would normally be expected in a traditional classroom.

Before a multi-media environment can justify its offering as being profitable to all learners, changes are needed which will assure the offering of greater learnings to the low achiever. Possible causes for low achievement as identified within Harmon's study and verified in this study are (1) the student may not have learned how to study, (2) learners may vary in the transition time needed to adapt to a multi-media individualized environment, (3) the media environment may be incapable of generating sufficient motivation to assure efficient learning, and (4) learners may exist who refuse to accept the responsibility of learning as being a student, not teacher obligation.

2. Select factors measured by the EPPS and GATB are capable of predicting term achievement within a multi-media environment such as that examined within this study. The best predictors in descending order were intelligence, abasement, autonomy, affiliation, and intraception. Of these five, general intelligence was found to contribute approximately five

times more weight than any of the other variables, based on a regression coefficient. With scores on intelligence and intraception at the 50th percentile or above and scores on abasement, autonomy, and affiliation below the 50th percentile, the ability to predict success or failure is at the 5% level of confidence.

3. The selection of a given media to initiate study for the high achiever student is not critical and success for him can be achieved with any media. The personality factors of students who selected particular media are as follows:

Students who selected verbal media as first choice exhibited a high need for doing and sharing things with friends and trying to understand how others feel about problems. They have a tendency to judge people by why they do things, rather than what they do. In some instances, they exhibited a high need to be the center of attention as well as a strong feeling of guilt when doing something wrong.

Students who selected the visual media exhibited a strong need to keep at a job until it is finished, to complete any job undertaken, to work hard at a task and not to accept other jobs until one is finished. In most cases, they had a need to do new and different things, to experiment and try new things, and to experience novelty.

A correlation between preference of media and the final grade in electronics was made to identify specific

traits that might help locate students who would have trouble in a multi-media environment, and to find those types of students who would likely be successfu. The level of significance was .16, well below the .25 required at the 10% level. Therefore, in this study, no significant relationship existed. The nature of these results suggest that learners may differ in the type of media which is best suited for all learners and all learning situations.

One trend noted by the instructor within this investigation was that the film or tape-slide presentations were often selected for introduction presentations. Written materials which could be more closely controlled in rate of progress were later selected for more in-depth understanding. The lab activity was generally used after an orientation or introduction to the material.

Future media offerings must accomodate for differences among individuals and/or for the media best suited for a variety of learning situations by providing for a variety of media types to be available within the learning environment.

The best predictors of success in electronics from the GATB are general intelligence, verbal aptitude, numerical aptitude, and spatial aptitude, all at the 1% level of significance. Personality variables which are usable for

predicting success in electronics are autonomy, affiliation, succorance, and abasement, all of which are significant at the 5% level of confidence.

The scores on traits of general intelligence and numerical aptitude were significant at the 5% level of confidence for predicting success and/or failure in psychomotor or skill development. Scores on verbal aptitude and dominance were close and should be given some consideration, although not numerically significant.

As expected the value between the objective test and the performance test was significant at the 1% level of confidence with an r of .28. The personality and aptitude factors usable for predicting success in information or cognitive achievement in electronics are general intelligence, numerical aptitude and clerical perception, which are significant at the 1% level of confidence. None of the factors evaluated on the EPPS are significant at a level that would be useful for making predictions. Therefore, it is concluded that the GATB is very useful for making predictions related to success on the information and cognitive level and that the EPPS can only be used to add support or strengthen the predictions.

4. The majority of students involved in the study said that they liked the individualized multi-media self-pacing instructional system and would recommend its continuance in

in the electronics lab. Fewer, however, would recommend that the system be used in other classes and adopted in the total college program.

A large majority of students involved in the study indicated that they had received very little information on how to study. Some indicated they had read information on their own, and then followed suggestions given, but had not spent time in formal instruction on the topic.

Only a few of the students involved in the study indicated that the GATB or EPPS or similar devices had been taken and interpreted by teachers in the school program. However, any interpretations made were not done for the specific purpose of helping the student set up a pattern of study or to help improve their learning process. As a general rule, the students had a general idea of how they felt about the relationships with others, but had not personally been confronted with the test results of the kind used in this study.

The majority of students viewed the Learner Controlled Education system in a positive manner, agreeing that it contained more advantages than disadvantages. The prime advantages listed were: (1) the opportunity of the student to seek exactly what he was to do under what conditions, and to what level of proficiency, and (2) the opportunity to proceed in a self-determined pace using a multi-media environment to achieve it.

Comments were made relating to the fairness of the test and the usability and helpfulness of the self-tests in the packets. As the tests were designed to measure only the stated objectives, the non-individualized or group instruction program can profit from these results by seeking to clarify student objectives to assure learner familiarization with expectation.

Most of the students indicated that the system did, in effect, cut down on the anxiety level of the student, regarding learning, although a few said it increased their frustration. A number of students said their initial contact with the system was one of fear, but that as time elapsed they found their anxiety being diminished as decisions were made within the program. A feeling was expressed by several students that "We want to make our own decisions, but we're not sure we will make the right ones."

Learners viewed some disadvantages of the multi-media individualized system of instruction. These in order of frequency were: (1) inefficiency in use of time, (2) difficulty in adjusting away from the traditional methods of instruction, (3) need for more frequent instructor presentations, and (4) the lack of motivation in studying the materials presented in the study guide. Items two and three appear to be organizational deficiencies which are largely correctable through the improvement of the media offerings. Items one

and four may not be totally correctable within the structure of a multi-media environment. However, its effect can be lessened by the construction of media offerings which allow for greater recognition of individual rates of progress closer contact with the instructor to motivate student's learning.

Suggestions to reduce present inefficiency in use of time include greater utilization of written materials (which, by nature, can be controlled in rate) and tape-slide offerings such as available within the study. The tape-slide offerings within this study utilized a special "response" mechanism, which allowed for variations in learner time required for response. Part of the learner comments due to "inefficiency in time" were due to the freedom given to the students and the inexperience of the students to make judgments regarding sequence of media used and time utilization within the lab.

The use of carefully organized Learning Activity Packages which included instructions for coverage of the unit, were obtained by the learner when he fulfilled the objectives of the previous packet. Thus, fast learners progressed at accelerated rates with minimum loss of time and better efficiency within the class. Those who needed more time could use the packet as a home-study guide.

5. In general, the LCE system was accepted favorably by a majority of the students. The greatest concern of the students seemed to be related to the quality of the media available. This is understandable, as the films, tape-slides, and so forth were adapt from other programs and in the main, not specifically designed for this program. A number of the students indicated they liked group study activities. These group activities were discussions of two or three students and were deemed beneficial within a multi-media environment.

When time spent in group activities was correlated with term achievement, a positive relationship was found to exist. However, its magnitude did not indicate the time spent in group activity to be a significant predictor. These results imply multi-media offerings should acknowledge the social nature of the learner by affording opportunities for group study activities. Media offerings would profit from structuring its offering to accomodate group as well as individual study activities. Analysis of instructor comments indicated that study groups which exceeded three learners were observed as diminishing in effect. Future media group activities should limit the size of study groups to no more than three learners.

6. In making a comparison of the recommendations of students to continue an individualized multi-media Learner Controlled

Program, a greater percentage of students expressed a positive approach for continuing the program as it now exists. The negative results interpreted within the pilot study created numerous structural changes within the program. Their results were reflected in greater acceptance of a multi-media environment, as indicated by the follow-up study.

Suggested structural changes in the LCE system include the following: (1) gradual rather than sudden introduction of media within the curriculum, (2) continuance of daily study guides with increased emphasis on assuring complete student understanding of expectancies and the use of the activity packet, (3) more frequent tests administered by the teacher from the self-tests in the activity packets, (4) establish formal blocks of class time when attendance is mandatory and the instructor makes presentations, (5) increase the number of short instructor presentations till the media is restructured to better accomodate the need for such presentations, (6) restructure media presentations to allow for overview of the material to be presented, (7) greater articulation with past understandings in consequent departure from the single concept presentations, and stressing greater practical application of applied principles, (8) more thoroughly familiarize learners with guidance duties of the instructor, he is not to serve as

the only informational source for specifics, (9) increase the tape-slide media offerings, (10) adopt use of the EPPS and GATB for guidance purposes within the multi-media environment, especially for identifying the low achiever, and (11) require the daily recording or evaluation of student answers to study guide questions and self-tests which appear in the Learning Activity Packets.

7. The lack of motivation was stated as a disadvantage frequently listed by learners who participated within this investigation. Much of this criticism is thought to reflect the need for improvement in media materials and in its environment. A greater responsibility for motivation needs to be placed on the teacher.

Media changes which were identified within this study will enhance student motivation are: (1) single concept offerings must be expanded to allow the learner to better relate his past with his immediate media topic being presented, (2) media offerings must include practical illustrations of the application of the informal topic, and (3) learners should become more familiar with the perceived purpose for undertaking each unit of instruction, and be encouraged to read the rationale, objectives and study guide questions provided in the Learning Activity Packets.

8. If the schools are to operate as an instrument of a dynamic, progressive society, then the schools should be preparing

students to live in that environment. Social psychologists have developed a preference as to which tie-structure individuals should try and develop to the world around them. The schools should seek to develop individuals who are personal, not anti-personal; more independent, not negatively independent. Students who tend to seek more information on which to base their judgments, who behave coolly under stress and who take responsibility and make wise judgments in their personal-social lives. The individualized, multi-media, Learner Controlled Education system developed, to some, degree, these types of individuals. Also, from the instructional standpoint, the attitude of the teacher changed as experience in this type of environment left the inter-personal decision making to the student. A greater rapport was developed between the teacher and student in this 'responsive environment.'

Recommendations

The following recommendations were drawn from the study:

1. The General Aptitude Test Battery and the Edwards Personal Preference Schedule have been shown to be effective predictors of term achievement. GATB has a greater reliability for prediction than does the EPPS. Nevertheless, their predictive capabilities are statistically limited, suggesting other criterion exists which are also effective predictors of achievement within a multi-media environment. It is felt

that an interview by the teacher with each student would be very helpful in adding to the reliability of the prediction for success or failure in the program. Consideration should be given to the use of other personality tests, such as the "16 Personality Factors" test. Future study is needed to identify other factors which could be used for prediction. Such possible factors include sex, age, hobby and interest, and previous experience in electronics.

2. Based on information received from students in this study, more time should be spent in the educational program from kindergarten through the university on teaching people their strengths and weaknesses, and how to use these variables in the learning process. The schools need to prepare students to teach themselves through purposeful teaching.
3. It is essential that any teacher or educational environment have the opportunity to allow the student and the teacher to interact with the material being studied. Lack of personal involvement and contact between the student and teacher reduces the amount of motivation on the part of the student.
4. An orientation for each of the lessons contained in the Learning Activity Packets should be made available to those students who wish to participate. This would include a ten to twenty-minute brief overview of what the lesson was about, and how the student might integrate this into his existing

knowledge about the area. For those who deem it necessary, a second contact with the teacher should be done over the material covered in a review.

5. Select learners within this study were identified who did not appear to reach acceptable levels of term achievement, suggesting that not all learners profit from a multi-media individualized self-pacing environment, such as was applied within this study. Future investigations should attempt to identify the low achiever, determine causes for low achievement, and suggest corrective measure. Perhaps a multi-media environment cannot be structured to assure acceptable levels of achievement from all learners.
6. Learners reacted favorably to the privilege of studying in groups which contained two or three members. This suggests that individualized instruction may best be applied in group study activities with two or three students rather than through a totally individualized situation so frequently suggested in contemporary literature. This relationhsip should be pursued in further studies. Two factors are suggested to guide the future investigations: (1) analyze the effects of group study activity on learner attitudes including motivation, and (2) analyze the relationship between term achievement and time spent in group activities.

7. This study, as was the pilot study, was unable to fully investigate whether learners differ with respect to the type of media used for effective learning. Future studies should be continued to investigate the relationship between the selection of media type and tha aptitude or capabilities of the learner. Such studies should also investigate the sequence of media type which are most appropriate for effective learning.

8. Although the instructor within this investigation spent each class session in continual interchange with individual learners and in presenting overviews to the material, the learners viewed instructor presentation as experienced in the usually teacher-dominated classroom as offering greater teacher-student relations than that obtained within a multi-media individualized environment. This finding is contrary to the stated assumption governing a multi-media individualized environment. Future studies should investigate the nature of student-teacher relationships within a media environment, views of this relationship by the student and seek means to cultivate greater student-teacher relations. This relationship could be enhanced by the use of the interaction analysis technique.

9. For beneficial learning to occur, two outcomes are essential: (1) the learner must acquire information and skills, and

(2) the learner must acquire motivation. Multi-media individualized programs appear able within limits, to fulfill the first outcome. However, as identified in this study and the pilot study, the relationship between motivation and the use of multi-media environment is not understood. Future studies are essential to seek means of structuring individualized environments to assure maximum motivational outcomes.

10. Student responses within this study and the pilot study indicated that learners viewed a multi-media environment as contributing towards preparing one to learn on his own after leaving the formal school program. Future studies should investigate the longitudinal effects of multi-media individualized self-pacing learning programs with regard to this highly important outcome. This could well be the prime advantage of a media environment.

A follow-up study should be made of the 196 students in this study to see if in fact improvement in learning did occur with the students who experienced this program and if possible, to determine the degree of change.

11. Replicate this study using test scores on the Edwards whose level of consistency is at the norm or above. This would allow a more valid profile of each student to be developed and increase the numbers for correlations. Another possibility is to replicate the study using the "16 Personality Factors" test.

APPENDIX A

INDIVIDUALIZED INSTRUCTION: A MEANINGFUL EDUCATIONAL EXPERIENCE

Dr. David L. Jelden
Department of Industrial Arts
UNIVERSITY OF NORTHERN COLORADO

Introduction:

We can no longer doubt that we live in an age of rapid expansion. Knowledge is proliferating in virtually every field imaginable. The rate of expansion is explosive! Somehow, man must find his way through a tangled maze of knowledge, assimilate it, ... and qualify himself to move on into a complex future.

The complexities of our times have developed so rapidly that a startling fact now exists. Of all the scientists that have ever lived -- ninety percent are alive today! The growth of scientific knowledge has accompanied the growth of industrialization. And today, a thorough knowledge of our industrial society is essential to bridge the gap between the present and an increasingly complex future. It is for this complex industrial future that we must prepare our childre

Look at the people around you for a moment. You can hardly help noticing how people differ from each other. Different faces--different statures--different general appearance, different attitudes and preferences...and of course, other more obvious sexual differences. Our children, too, differ from each other. Asid from obvious physical differences, there are less obvious emotional differences. Some, for example, seek companionship. Some, again, do not. No matter what our children are like, we must give them the best education we can by using the best possible methods.

Educational leaders who have studied many problems of learning have turned up some useful facts. They tell us that: the learners' ability to retain the information they study amounts to..."10% of what they read...20% of what they hear... 30% of what they see...50% of what they see and hear...70% of what they say as they talk...and 90% of what they say as they do something."

From these data, we can derive certain essential principles. Among them these: students need to develop individual responsibility and the skills of independent study...students need opportunities to develop inquiring minds...students need to learn the skills of effective discussion...they need to acquire far more complex talents for effectual human relations...students need satisfaction in learning. The student who experiences directed problem-solving will not soon forget. No amount of verbalizing can replace the perceptions and self-realization gained when the students learns in a problem-solving atmosphere. What better approach to problem-solving is there than independent study?

Education: A Continual Process

To help promote independent study, it is imperative that teachers do not view the process of education as a terminal program.

Teachers should establish an environment in the classroom where the student becomes more responsible for his own education. Far too often, the teacher has been a presenter of information and the student a passive recipient of it. As a result the student did not reap all of the benefits of his learning opportunity. The traditional teacher-lecture system of instruction will not do the job in the years ahead.

Industrial arts has not as yet fallen too far into the crevice of theoretical learning because of its inherent manipulative characteristics. Because of this, industrial arts has been more meaningful to the student than some of the other areas of study. Its manipulative character is part of its uniqueness. Never the less, more emphasis should be placed in our teacher preparation programs and in our labs on the individual learning problems of students.

We in education need to develop within our students the individual and necessary skills of learning so that the experience obtained in a formal school situation will carry into later life. This does not mean that we need to add more methods courses to our teacher education programs but that in the classes which we now teach in all subject matter areas, the students should have more personal involvement in the learning process. Learning should become an individual, on-going process far after the student leaves the full time school.

Much has been written relative to the amount of emphasis being placed on gadgets and hardware in modern educational programs. In fact, we may be overemphasizing the gadgetry at the expense of teaching individual learning skills. While industrial arts should make use of all the facilities, techniques, and gadgets that it can to increase and enhance learning, these gadgets and bits of hardward should not take the place of a sound understanding on the part of each individual as to how he learns best. We need to teach the technique of learning and the utilizatio of these gadgets found in educational technology. An innovative approach to education which effectively uses these theories is Learner Controlled Education.

Learner Controlled Education: A Definition

Learner controlled education is defined as a system of instruction that is individually oriented, self-instructional, and multi-media in approach. It is based on the premise that students can be taught to interpret the behavior goals of acourse, determine procedures that will permit attainment of the goals, and select and carry out the procedure which they consider desirable for attaining the goals. The learner controlled method is in contrast to the teacher-controlle method in which the teacher establishes the goals and determines the approach by which the outcomes will be reached. In both methods, content, in the main, is determined by the teacher. The methods differ in terms of who determines the procedures for attaining the goals. Putting it bluntly, the teacher does not impose his method of learning on the student.

Organization of Learner Controlled Education

Learner controlled education (LCE) is organized essentially the same as any other good program of education now in operation. The difference is found in the method of instruction used to achieve the goals of the course. The uniqueness of LCE lies in the general classroom organization and in the freedom and responsibility given to the stu in his class work.

Evaluation

The process of evaluation in learner controlled education will take on a different meaning than it has had in the traditional classroom. The emphasis is

placed on critical self-evaluation. Tests are administered by the student on his demand. Items on the examinations are keyed to the master analysis chart to facilitate the reference for more information on the particular topic. There is provision for a comprehensive examination over the entire course which is a teacher scored final examination. This examination, however, is made up of material which was covered in the self-evaluations taken previously by the students. In addition there is a manipulative performance examination administered to each student by the teacher at the conclusion of the coursework.

Evaluation in the Learner Controlled Education program takes on another dimension beside that of student progress in course work. An evaluation is made of the aptitudes and personality needs of the student. This is accomplished by having the General Aptitude Test Battery and the Edwards Personal Preference Schedule administered and interpreted to each member of the class in the early part of the course.

This kind of information will allow the teacher to predict in general the success or failure of each student in an individualized program of instruction. By this means those who may have difficulty can be identified early before they experience repeated failure. Research has shown that student aptitudes of intelligence, form perception, verbal fluency and spatial interpretation are closely related to predicting the success or failure. Furthermore, statistical treatment of the data identifies general intelligence as the most important single aptitude.

Personality evaluation is accomplished by interpreting the results of the scores obtained on the Edwards Personal Preference Scale. This test is an attempt to identify the manifest needs of individuals. It identifies what characteristics an individual possesses and what it takes to make him feel comfortable. The most important characteristics as they relate to the success of an individualized program are abasement, autonomy, affiliation and intraception. Research has shown that all of the values are significantly related to success in an individualized program and may be positive or negative in value.

Therefore, by looking at the scores in general intelligence and intraception above the 50th percentile and scores in abasement, autonomy and affiliation below the 50th percentile, we can be reasonably sure that 95 times out of 100 the student will be successful in an individualized program of instruction. Likewise, any variation from the lower or higher portions of the scale can be used to identify possible failures. Additional research needs to be done in an individualized, multi-media environment to validate these success and failure profiles and hence expand the predictability pattern.*

THE ROLE OF THE TEACHER

In Learner Controlled Education, the teacher plays a slightly different role than is traditionally believed. The teacher becomes a resource person, another source of information that the student can utilize in achieving his goal rather than a pure presenter. The teacher takes on the role of an educational counselor whose primary responsibility it is to make suggestions, pose questions, and guide the student to the various resources which enhance and increase the understanding of the topic or problem at hand. The teacher does this by utilizing the information of the individual's personality and aptitudes obtained in the individual evaluation.

* Jelden, Dr. D.L. "Predicting Success in Individualized Instruction," 2-year staff study on individualized instruction, U.N.C. Greeley, Colorado, 1971.

THE FUTURE OF EDUCATION

The basic argument of an individualized method of instruction is that it can and will provide for the flexibility that is needed in future educational experiences. The rapidity of change is making it increasingly difficult for curricula to remain current within the framework of the formal classroom methods that are now commonly used. Further, even if classroom procedures could become more flexible, the traditional method is not amenable to providing for individual retraining and upgrading needs. If man can be taught to teach himself and make use of available resources to attain the needed knowledge and skills, then the retraining and upgrading problem can partially be achieved through individual study.

The solution is not all this simple, however. That man can teach himself is self-evident. The majority of man's knowledge and skill likely is self-taught. It is not self-evident, however, that man is naturally an efficient and effective learner in a self-instructional situation. The success of study skills experiments is testimony to the contention that man's skill at learning can be improved.[2,12] Further, the phenomenon of "learning how to learn" that has been put forth also suggests that man learns this ability, and if it is learned, then the degree of this learning in any person would be at some point on a continuum from low to high.[7] Learning procedures are not general for all learning outcomes.[6] Learning strategies may differ in efficiency and effectiveness depending upon whether the outcomes differ in terms such as being cognitive, psychomotor, and affective. This implies then, that man should be taught or should learn those strategies individually that are effective or relevant to the learning outcomes involved in a particular task.

RESOURCES FOR EDUCATION

Even if man can be taught to teach himself, then there is the problem of his having sufficient resources available for learning what is needed. One of the primary tasks of the educator or teacher in the individualized method would be to know what resources are needed for any learning task and to make these resources readily available to the learner. The efficacy of the provision of a variety of resources and learning materials has been demonstrated for young children. A study reported on a 'responsive environment nursery school' in which one of the essential features is the provision of an 'enriched social, vital world' with which the child can interact.[11] Other studies have reported similar results with young children in enriched settings.[4, 9]

The "responsive environment" in a nursery school is essentially an environment in which a wide variety of resources are available for the young learner. The provided variety is not, however, just a random collection of things but rather is a collection of materials in which each component has some purpose.

Although the "responsive environment" procedure has been demonstrated only with young children, it seems reasonable to expect that the same type of situation would operate effectively with other age groups. An adult who is more capable of independent effort that a child should be capable of operating even more effectively in an appropriate "responsive environment" than the young child.

Thus, if the student knows the level of knowledge and skill he will be expected to attain and the proficiency he should reach at the end of the course, if he knows the learning strategies that can be effective for him in attaining these ends, and if certain combinations of resources are effective for him in attaining these ends, and if adequate resources are provided, then the student should be able to be self-directive in his study and control his own learning. (This assumes prior knowledge on the part of the individual on how he learns best and sufficient motivation from within.) Further, the learning should be attained more quickly and be more meaningful to the student than it is in the traditional classroom situation. The basis for this expectation is that self-directec learning is generally more motivating and the enriched environment of the wide variety of resources will allow for a more generalized understanding of the learning because of the opportunity to practice and deal with the concepts in a variety of situations.[5] To promote this self-direction in learning, individual learning activity packets have been developed.

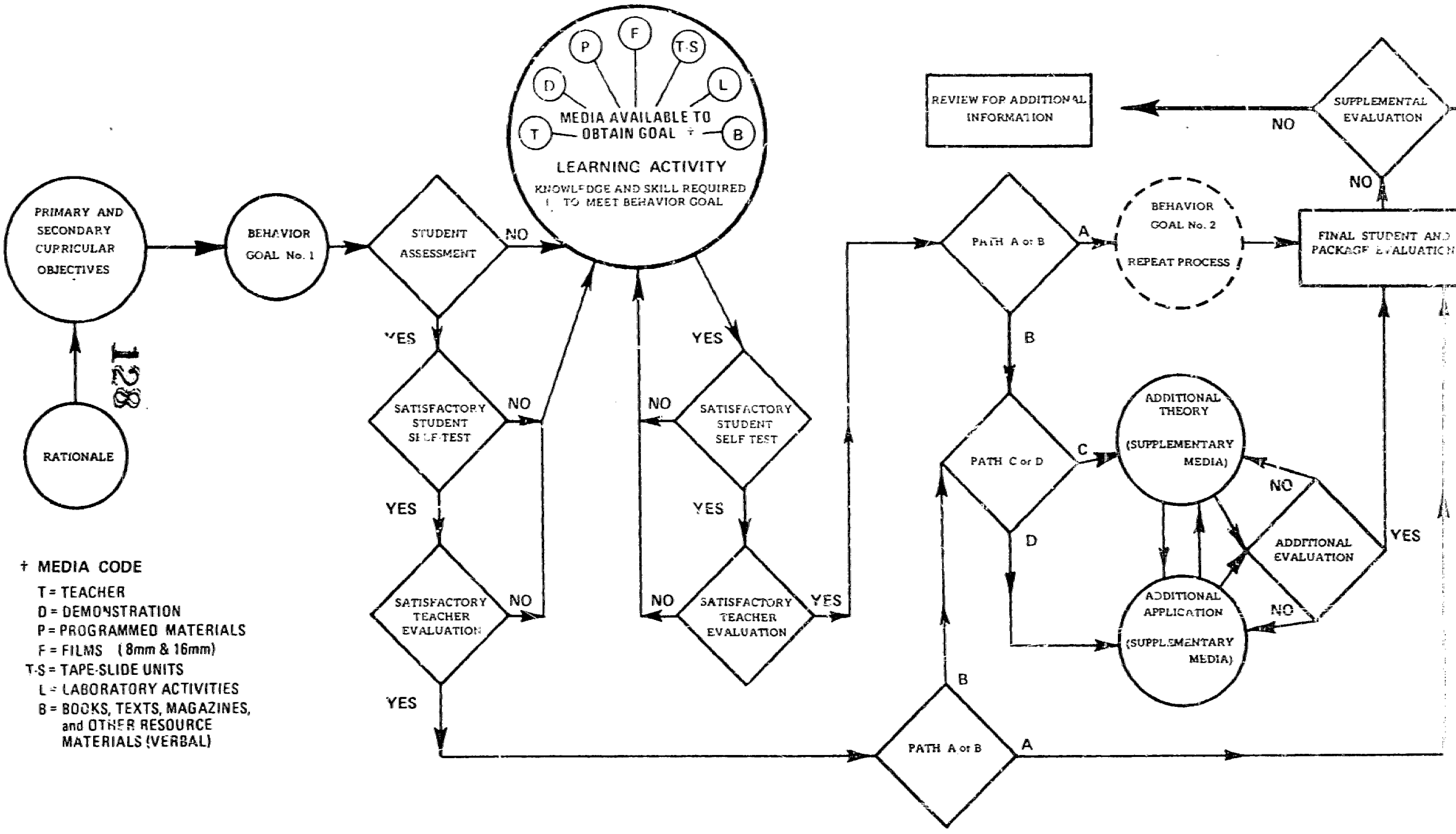
LEARNING ACTIVITY PACKETS

The LEARNING ACTIVITY PACKETS are designed to be used by the student to learn on an individual, self-pacing basis. The educational construct for the LEARNING ACTIVITY PACKETS can be explained best by reviewing the sequence undertaken by the student as he proceeds through the lesson.

This is not just another lab manual developed to be used in a program as additional activity but is a total 'package'. It consists of behaviorally stated educational goals, recommended sources of information to achieve those goals, choices of sequence preferred by the student, self-evaluations integrated into the lesson, and a packet evaluation desinged to have the student explain in his own words his understanding of the task or educational goals.

To explain in detail the theory behind the development, look carefully at the 'educational flow chart' found on the next page. Follow the arrows from section to section as it is explained, beginning on the left-hand side with the circle containing the words "primary objective."

LEARNING ACTIVITY PACKAGE



† MEDIA CODE

- T = TEACHER
- D = DEMONSTRATION
- P = PROGRAMMED MATERIALS
- F = FILMS (8mm & 16mm)
- T-S = TAPE-SLIDE UNITS
- L = LABORATORY ACTIVITIES
- B = BOOKS, TEXTS, MAGAZINES, and OTHER RESOURCE MATERIALS (VERBAL)

UNIVERSITY OF NORTHERN COLORADO
Greeley, Colorado

LEARNER CONTROLLED EDUCATION SYSTEM

Dr. D.L. Jelden

The "primary objective" as outlined on the 'educational flow chart' can be identified as the over-all purpose of the lesson. Simply stated, it asks the question: "What is it that I should understand when I finish with this block of information?" In most instances the "primary objective" can be identified by the title of the packet. The "primary objective" of this learning packet must deal with the characteristics, purpose and application of electricity. The "primary objective" can be compared to the unit title, or chapter heading found in traditional textbooks.

One of the big headaches in any educational experience is the development of individual motivation on the part of the learner. Motivation is in fact one of the most important aspects of any educational experience. Without it, learning does not become an enjoyable, meaningful venture.

The rationale found in the LEARNING ACTIVITY PACKET is designed to explain to the student why it is important for him to understand this particular phase or the area under study. It will explain the relationship that exists to future topics or applications in the field and may in some cases develop a relationship to his past experiences. It should answer for the student these continual questions: "Why is it important that I understand this particular lesson? What relevance does it have for my existing world or purpose? What good can I expect from time spent in studying this block of information?" It should appeal to his power of reason and unlock the door to internal drive that is essential to any good learning experience. For some students the teacher may have to supplement verbally the rationale of the lesson.

Once the primary objective and the rationale have been identified and the student sees a good reason for studying, it is essential that the learner understand exactly what it is he should know. To make learning as functional as possible, specific behavioral objectives or tasks can be stated in such a way that the student knows not only what it is he is expected to learn, but under what conditions and to what degree of proficiency the task must be mastered.[14] For example, if an educational goal was stated in behavioral terms as follows:

> "Given a schematic diagram of a simple electronic circuit, the student will be able orally, in writing, or by demonstration to identify the components of the circuit from parts found in the test bench and do so correctly 8 out of 10 times."

There would be little doubt in the mind of the learner what was required of him upon completion of the lesson. Likewise, the teacher can make a valid evaluation of the learning experience.

With this kind of terminal behavior, the teacher can structure learning experiences that relate directly to the task, and the student can begin to study those parts of the task that will allow him to perform it under the stated conditions.[15]

In the LEARNING ACTIVITY PACKET, the objectives and recommended ways of achieving them have been laid out, so that the student begins the learning process with as much efficiency as possible.

One of the primary purposes of education is to make the individual involved develop a valid and reliable method of making judgments about himself. In

learning, because individuals differ and each has a unique background of experiences, an opportunity for students to make self-assessments should be provided.

In the LEARNING ACTIVITY PACKET the students are given three choices to determine their degree of understanding of the behavioral task set before them. They are:

1. I understand ALL of the tasks and therefore have the required knowledge and skill to perform them.
2. I understand PART of the tasks and will study those parts with which I am unfamiliar.
3. I understand NONE of the tasks and will proceed with the student of the lesson as recommended by the packet.

By giving the student these three choices, the teacher can identify those who have already attained the stated behavioral goal and can give credit to the learner for the knowledge. In this way the teacher can actually provide an accelerated path for those with previous knowledge. Likewise, for those whose background is not so complete and for those who have not had the opportunity to learn or have forgotten the material essential to completing the stated task, provision in the learning activity can be geared to meet their specific need.

It should be pointed out that accurate judgments on the part of the student can be verified by self-tests. As the learner makes judgments of his educational experience, reinforcement of the quality of that judgment is essential to develop the validity and reliability of it. In reality, the learner has to take the responsibility for his decisions, and only when he is truthful with himself can he begin the meaningful process of education. The development of a truthful student assessment is a big step toward individualized learning and can be achieved only through opportunity and experience.

At this point on the "educational flow chart", the student must make his assessment of how well the task can be performed and what alternatives are available to him once the choice is made.

For the student who thinks he can achieve the behavioral goal, provision is made in the system to take a self-test over his understanding of the task. The self-test usually involves objective questions and, in instances where required, essay items. Also, in some cases a performance or manipulative examination is required. The idea being, the self-test is a verification of the learner's assessment of how well he can perform the stated task. For those who need help in their evaluation or for those who have questions over material related to the task, the teacher can be involved with the evaluation. If both the student and the teacher are satisfied that achievement of the goal is complete, then the minimum requirement of this objective has been attained.

If additional interest or need is present for some in-depth or concentrated study over and above the minimum task requirements, provision is made for this quest. Information is given to the student at the end of the self-test to allow the learner to obtain additional knowledge and skill in the area under study. The depth of this study is strictly up to the student, and its time duration is dependent upon the demands of the teacher or time remaining in the program.

This path is identified on the "educational flow chart" as Path 'B', Additional Theory or Additional Application and is encountered after a successful teacher evaluation of the required behavioral objective.

The other alternative available to the learner, that is, one who does not have any background for completing the task or one who has only a partial understanding of it, is to pursue the lesson recommended by the study guide.

The LEARNING ACTIVITY PACKETS have a learning activity section which contains several elements:

1. A list of recommended media available where information can be obtained which will allow the learner to gain information about the task.
2. A list of helpful study-guide questions that, when answered by the student, will allow him to understand the objective or information related to it.
3. A laboratory experience, if feasible, that will give an opportunity to apply certain ideas or knowledge on a practical basis.
4. An information sheet that will summarize the basis of the task or its essential parts.

Once the student has entered the learning activity, he will then proceed to the self-test whenever he is satisfied in his own mind that he can achieve the tasks set forth in the lesson. If the self-test proves that the desired level of achievement has not been reached, a re-cycling back into the learning activity is prescribed. This process is repeated until the student and the teacher can agree that sufficient knowledge and/or skill is present to allow the student to continue into the next phase.

As briefly described under the accelerated track, additional in-depth study can be undertaken by the student if a need exists. It provides some additional sources for the learner to pursue an individual quest to supplement the minimum requirement of the lesson at his leisure. The minimum requirement as identified on the "educational flow chart" is exemplified by following Path 'A' as outlined. The additional in-depth study is charted as Path 'B' and can be approached by the accelerated track from below or from the initial contact track from the top as shown on the chart.

Some larger primary objectives may have several specific behavioral tasks or sections included in them. If this is the case, the student would look at behavioral objective #2 and repeat the process starting at the student assessment and making the same judgments as described previously.

Upon completion of all the specific behavioral objectives of the LEARNING ACTIVITY PACKET, the learner and the teacher must make a comprehensive packet evaluation over the entire assignment. This evaluation may take the form of an oral interview, a written essay test, a laboratory performance test, or any combination of these. It should be realized that the purpose of this evaluation is to get, in the learner's own words or actions, his understanding of the primary objective and his ability to meet the specific behavioral tasks identified in the LEARNING ACTIVITY PACKET.

If, after a brief discussion, some voids or discrepancies in the evaluation exist, additional suggestions can be made by the teacher to help the learner improve the over-all understanding of the lesson and the completion of the packet

The LEARNING ACTIVITY PACKET is so designed to provide for the learner, a self-pacing, individualized, multi-media system of education. If used properly, it frees the teacher from highly structured classroom lectures and allows him to help guide the learning process of the students.

Most of the materials in the LEARNING ACTIVITY PACKET provide for self-study On occasion, a teacher demonstration or lecture may be the best way to present certain kinds of information to a small group of students within the class. What the LEARNING ACTIVITY PACKET will do best is provide for the individual differenc of the students and place the teacher in the proper professional role as a diagnostician or prognosticator of the educational process rather than a regurgitator of factual information which a machine or some form of educational media might do better.

ASSUMPTIONS OF LEARNER CONTROLLED EDUCATION

The following statements are some of the basic assumptions on which we base the idea of "learner controlled education":

1. It will be improbable and perhaps impossible to keep our schools up to date in a dynamic technological society.
2. The development of learning skills is as important to teach as the subject matter itself. However, both can be taught simultaneously under a well structured system.
3. It is unnecessary to send people back to school in a formal classroom atmosphere for updating as often as some educators have advocated. If the student is properly motivated, continual self-instruction is a reality.
4. The student is capable of determining his own course of action once he is made aware of the possibilities and alternatives open to him in finding answers to his questions.
5. A wide variety of resources must be available to the student for an effective individual learning situation. These resources may take the form of many instructional media.
6. Each student should know or will learn what his strengths and weaknesses are as they relate to how he learns best.
7. When an educational goal is understood and is some cases set by the student, its attainment is more personal, the motivation is stronger, and its achievement more rewarding.
8. Initially learning may be slow, but over an extended period more materi can be covered better in a shorter period of time. The student will ge better, more meaningful learning.

CHARACTERISTICS OF LEARNER CONTROLLED EDUCATION

The learner controlled system of instruction under operation at Colorado State College exhibits the following characteristics:

1. The student will be instructed on the procedures of the course, the equipment he will be using, and will then work independently.
2. The content of the course and the goals of the course will be based on a determination of the knowledge and skills required for success in industry. This determination has been completed on the basis of several studies.[1,3,8,13]
3. The materials will be analyzed and cross-referenced by topics. The learning objectives will be isolated to provide information to students as to which resources are available for the various objectives of the course. This analysis is the heart of the classroom operation. All test items or evaluative instruments will be cross-referenced to the master analysis chart and related to the behavioral goals of the topic under study.
4. A variety of media is available for the course. The materials will be in the form of several basic media: programmed texts and machines, reference books, slides with tape narrations, tapes, workbooks, 35mm strip films, 8mm and 16mm films, video tapes, overhead transparencies, laboratory equipment and lecture-demonstration by the students and/or teacher.
5. Evaluation of student progress will be done individually over small blocks. When the student believes he has attained the outcomes of objectives of a given block, he will undertake his own self-evaluation. Immediate feedback will be provided the student and if the goal has not been reached, additional study materials or activities will be suggested
6. Final grades are determined by a comprehensive objective examination ove the informational phase of the course and a performance examination over the manipulative phase. The proficiency level of each part is determine by the teacher and is made clear to the student prior to study.

THE COST OF INDIVIDUALIZING INSTRUCTION

The learner controlled education system does not require any new types of materials or any radical changes in curriculum content. It is merely a better utilization of the materials which are already being used by teachers and allowin a greater emphasis to be placed on individual differences and individual initiati It is understood that because of the traditional teacher-lecture passive student relationship that exists throughout the educational system in the public schools, that this new found freedom on the part of some students will be too much for the to control. In these instances the teacher must make provision to operate on the old teacher-lecture organization on a temporary basis for these students. The responsibility may come slow to the poorer student. This technique of self-teaching is something that will be learned over a period of time rather than accepted at a moments notice.

Programs in English and social studies for the drop-out have been organized around the learner controlled concept of education. Experience has shown that these drop-outs have been able to adjust and accept the responsibility for their own education in these areas, provided proper interest, guidance and motivation are available.

As in any new program proposal there are errors, problems and weaknesses. It is felt that these can be overcome and that the advantages gained, from the standpoint of the student and the total educational program, will overshadow the difficulties developed. All in all, it appears that the learner controlled education system will let us educate our students for the future as well as for today.

REFERENCES

1. Brown, G. J. Manipulative Operations and Electronic Equipment Needed in Industrial Teacher Education Based on Industrial Practices. (Unpublished doctoral dissertation, University of Missouri, 1960).

2. Brown, W. F. and Holtzman, W. H. "Study attitude questionnaire for predicting academic success." Journal of Educational Psychology, 1955.

3. Coleman, W. D. Physical Science Understanding Important to the Education of Industrial Arts Teachers. (Unpublished doctoral dissertation, Colorado State College, 1966.)

4. Deutsch, M. "Nursery education: The influence of social programming on early development." Journal of Nursery Education, 18, 1963.

5. Duncan, C. P. "Transfer after training with single versus multiple tasks." Journal of Experimental Psychology, 55:63-72, 1958.

6. Gage, N. "Theories of Teaching" in E. Hilgard (ed.) Theories of Learning and Instruction. Part I, 1964 NSSE Yearbook.

7. Harlow, H. F. "The formation of learning sets." Psychology Review. 56:51-65, 1949.

8. Jelden, D. L. Electrical Information Content Included in Industrial Teacher Education vs. Knowledge Required of Electronics Technicians. (Unpublished doctoral dissertation, University of Missouri, 1960.)

10. Neidt, C. O. Changes in Attitude During Learning Experiences. Colorado State University, 1964.

11. Nimnicht, G. and Neier, J. "A first year partial progress report of a project in an autotelic responsive environment nursery school for environmentally deprived Spanish-American children." Journal of Research Services, 5:3-34, 1966.

12. Shaw, J. G. "An evaluation of a study-skills course." Personnel and Guidance Journal, 33:465-468, 1955.

13. Maness, Marion. A Critical Analysis of Integrated Circuits with Implications for Industrial Teacher Education. (Unpublished doctoral dissertation, Colorado State College, 1969.)

14. _____. A Systematic Approach to Developing and Writing Behavioral Objectives. Tucson, Arizona: Educational Innovators Press, Inc., 1968.

15. _____. Educational Objectives. An audio tape filmstrip presentation. Los Angeles, California: Vimcet Associates, 1967.

APPENDIX B

BASIC ELECTRICITY
I.A. 80
LEARNING ACTIVITY PACKET TIME STUDY GUIDE

This time guide is for the purpose of setting some reasonable time limit for the completion of the activity packets. It is recommended that you follow the numerical sequence but it is not required that you do so. The mid-term exams however will be given over the first 6 packets. (#0 to #5.) Questions will cover items from self-tests in the Activity Packets. The deadline for completing and turning in any of the packet evaluations will be one week from the listed date of completion.

Packet Number	Estimated Lab Time	Date (Start	Complete)
Packet #0	6 hours	3-26-71	3-31-71
Packet #1	4 hours	4- 2-71	4- 5-71
Packet #2	4 hours	4- 7-71	4- 9-71
Packet #3	4 hours	4-12-71	4-14-71
Packet #4	4 hours	4-16-71	4-19-71
Packet #5	6 hours	4-21-71	4-26-71

4-30-71 MIDTERM EXAMINATION

Packet Number	Estimated Lab Time	Date (Start	Complete)
Packet #6	4 hours	4-28-71	5- 3-71
Packet #7	4 hours	5- 5-71	5- 7-71
Packet #8	4 hours	5-10-71	5-12-71
Packet #9	2 hours	5-14-71	5-14-71
Packet #10	4 hours	5-17-71	5-19-71
Packet #11	4 hours	5-21-71	5-24-71
Packet #12	4 hours	5-26-71	5-28-71

Performance test of PWR supply operation, series-parallelled circuits and measuring E, I, and R will be given during class time on May 26th and May 28th, 1971.

FINAL OBJECTIVE EXAMINATION--9:00-10:30 on Wednesday, June 2, 1971.

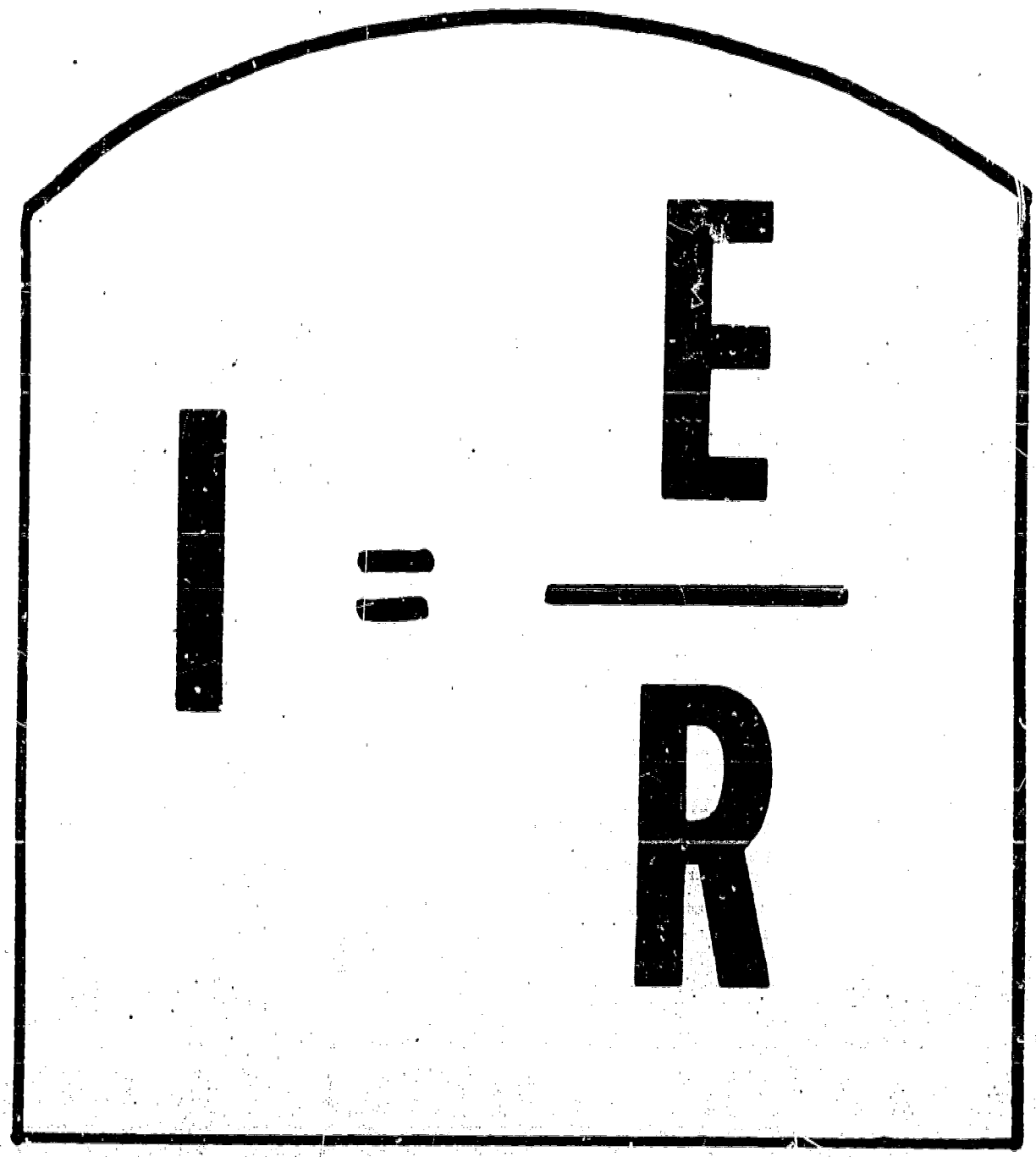
D.L. Jelden
Educational Consultant

APPENDIX C

Industrial Arts Department
University of Northern Colorado

OHM'S LAW

D.L. Jelden



CONTENTS

Name _____

OHM'S LAW

RATIONALE

Of all the natural laws associated with electricity the most widely used is Ohm's Law, which defines the relationship between voltage, current, and resistance. An understanding of this fundamental relationship is necessary before a person can understand many of the other concepts of electricity and electronics.

It is not always possible to measure all three of the basic electrical properties--voltage, current, and resistance. Through the application of Ohm's Law, any one of these properties can be calculated if the other two are known. Georg Simon Ohm, a German scientist, discovered that there was a definite relationship that existed between the voltage, current, and resistance in every circuit. This relationship is called Ohm's Law and states that the current is directly proportional to the voltage and inversely proportional to the resistance in the circuit. When the variables--voltage, current, and resistance, are all in basic units, the law can be stated as:

$$I = \frac{E}{R}$$

where I is the current in amperes
E is the voltage in volts, and
R is the resistance in ohms

Appropriate consideration must be given in those cases where the variables are not in basic units. In these instances the prefixes, milli, micro, kilo and mega are used to indicate division or multiples of the basic units.

In this unit you will be given the opportunity to study and apply Ohm's Law as it applies to electrical circuits. In addition you will become familiar with the prefixes commonly associated with the basic units--voltage current and resistance.

NOW TURN THE PAGE AND READ THE OBJECTIVES

TOPIC ONE

OHM'S LAW

A. OBJECTIVES

(_____) 1. Given the term Ohm's Law, you will be able to express orally or in writing the relationship that exists between the three variables of an electrical circuit. (p. 9-4)

(_____) 2. Given any two values of an electrical circuit, you will be able to calculate the third by applying the principles of Ohm's Law. (p. 9-4)

(_____) 3. Given an electrical circuit, you will be able to demonstrate the relationship that exists between voltage, current, and resistance. (p. 9-6)

B. STUDENT ASSESSMENT

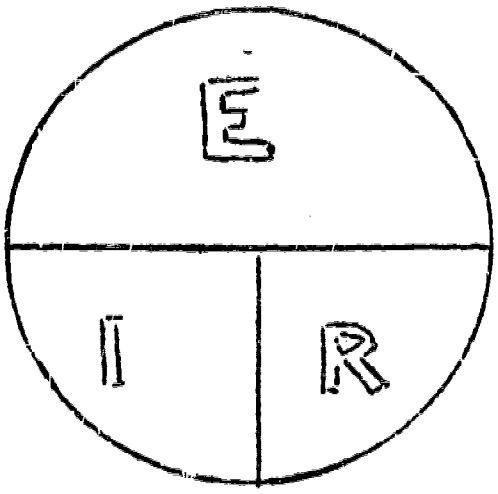
DIRECTIONS: Check (✓) one of the following tracks and pursue the action indicated.

(_____) I understand ALL of the tasks indicated in the above stated objectives and therefore wish to take the self-test found at the end of this section. (p. 9-9)

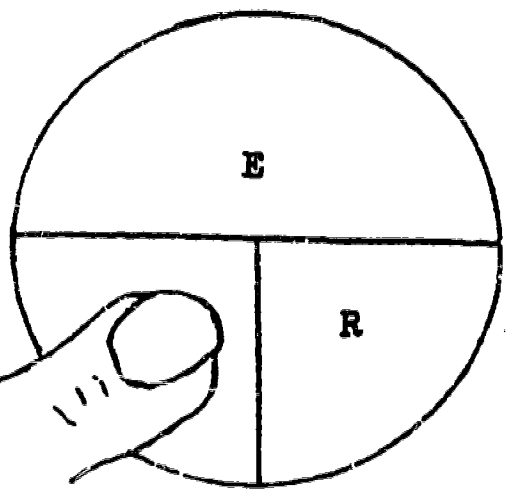
(_____) I understand PART of these tasks identified in the above objectives and will study those with which I am unfamiliar. When completed, I will take the self-test.

(_____) I understand NONE of the tasks identified in the above objectives and will proceed in the order recommended in this packet, beginning on the next page. When completed, I will take the self-test.

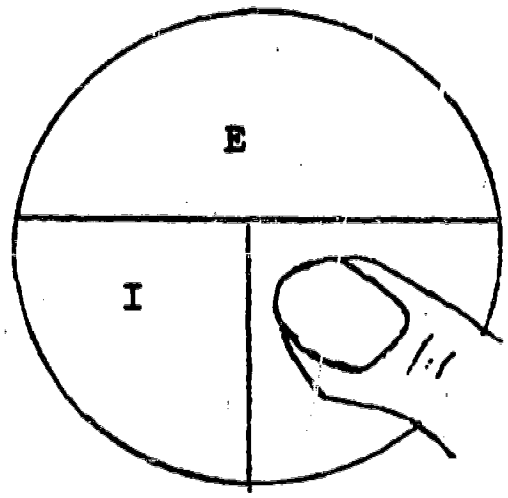
INFORMATION SHEET



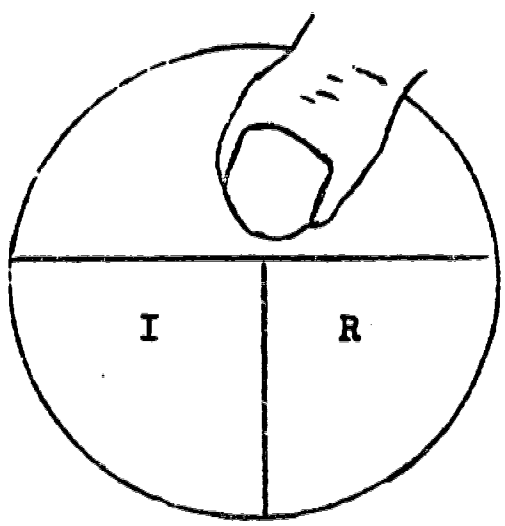
I = E/R



R = E/I



E = IR



The "pie" diagram is useful in remembering these equations for Ohm's Law. When anyone of the symbols is covered, the remaining two symbols represent the right-hand side of the equation for finding the value of the covered symbol.

TOPIC ONE

OHM'S LAW

RECOMMENDED MEDIA

(_____) 1. Mileaf. Electricity 1-7. Pgs. 2-37 through 2-43. Best coverage of Objectives #1 and #2.

(_____) 2. Van Valkenburgh. Basic Electricity. Pgs. 2-24 through 2-37. Good coverage of Objectives #1, #2 and #3.

(_____) 3. Lab Activity. See blue Lab Activity Guide in this section for details. Materials in/on lab benches.

(_____) 4. Garrish. Electricity & Electronics. Pg. 37-58. Brief but good coverage of Objectives #1 and #2.

(_____) 5. 16mm accelerated film. No. 23, Unit 4-D, Ohm's Law.

(_____) 6. 16mm film. No. 118, Unit 4-D, Ohm's Law. See film guide. Fair presentation for Objectives #1 and #2.

(_____) 7. Source of student's own choosing. _____

_____

_____

TOPIC ONE

OHM'S LAW - STUDY GUIDE

OBJECTIVE #1 Given the term Ohm's Law, you will be able to express orally or in writing the relationship that exists between the three vaviables of an electrical circuit.

OBJECTIVE #2 Given any two values of an electrical circuit, you will be able to calculate the third by applying the principles of Ohm's Law.

1. State Ohm's Law and give its three equations.

2. Given a circuit with a 15-volt battery power source and a 5-ohm resistive load, find the amount of current flowing in the circuit. (Draw the circuit and give all computations.)

3. If the resistance of a circuit is increased to four times its original value, what would have to be done to the source value, what would have to be done to the source voltage to maintain the original current flow.

4. In the space provided solve the following Ohm's Law problems. Write the form of Ohm's Law that you use in solving the problem and show all your work.

a. example: I=3 amps, E=6 volts, R=?

$$R = \frac{E}{I} = \frac{6}{3} = 2 \text{ ohms}$$

b. E = 4 volts, R = 100 ohms, I = ?

c. R = 200 ohms, I = 2 amps, E = ?

d. E = 6 volts, I = .2 amps, R = ?

e. I = .3 amps, R = 4,000 ohms, E = ?

f. R = 450 ohms, E = 24 volts, I = ?

TOPIC ONE

OHM'S LAW - LAB ACTIVITY

OBJECTIVE #3 Given an electrical circuit, you will be able to demonstrate the relationship that exists between voltage, current, and resistance.

Directions:

The following experiment will demonstrate the relationship that exists between voltage, current, and resistance in series circuits. All materials will be found in/on the lab benches. Check each step as you complete it.

Materials:

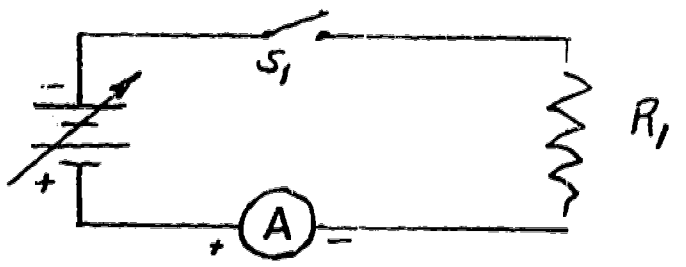
Power supply: source of variable DC voltage
VTVM
0-10 milliameter
Resistors: (½ watt or larger) one each
3,300 - ohm
4,700 - ohm
10,000 - ohm
15,000 - ohm
Potentiometer: one 10,000 - ohm, 2 watt

Procedure:

(_____) Step #1. Secure the above listed material and construct the following circuit using the 3,300 - ohm resistor. The switch in the circuit will be the on/off switch of the power source. Do Not Apply Power.

Variable DC voltage source

Low Voltage



(_____) Step #2. Set the VTVM for reading DC voltage and insert it in parallel with the resistance--between points A and B. (Observe polarity.)

(_____) Step #3. Insert the 0-10 milliammeter between point A and the resistor R_1. (Observe polarity.)

(_____) Step #4. Have the circuit checked by the instructor before applying voltage.
(instructor check_____)

(_____) Step #5. Turn the power supply on and adjust the voltage across R_1 to 10 volts.

(_____) Step #6. Measure and record the voltage and current in Table I below.

TABLE I

VOLTAGE IN VOLTS		RESISTANCE OF R_1	CURRENT IN AMPS	
MEASURED	COMPUTED		MEASURED	COMPUTED
10		3,300 ohms		
20		3,300 ohms		
20		4,700 ohms		
20		10,000 ohms		
20		15,000 ohms		

(_____) Step #7. Adjust power source to 20 volts and repeat Step #6. What should happen to the amount of current in the circuit?

(_____) Step #8. Turn off the power and then remove the 3,300 ohm resistor and replace it with the 4,700 ohm resistor.

(_____) Step #9. Turn the power on, adjust the source voltage to 20 volts and measure the current.

(_____) Step #10. Record the data in Table I.

(_____) Step #11. Turn the power off, replace the 4,700 ohm resistor with the 10,000 ohm resistor and repeat steps #8 and #9.

(_____) Step #12. Turn the power off, replace the 10,000 ohm resistor with the 15,000 ohm resistor and repeat steps #8 and #9.

(_____) Step #13. Turn the power off and return the equipment to its proper storage place.

(_____) Step #14. Using the formula I = E/R, compute, the amperage for each of the given resistances in Table I. (Show all work.)

(_____) Step #15. Using the formula E = I R, compute the voltages for each of the given resistances in Table I.

Problem:

What conclusions can you draw about the relationship of voltage, current, and resistance in series circuits?

TOPIC ONE

OHM'S LAW - SELF-TEST

My Score _____%

DIRECTIONS: This self-test is to be completed when you feel the objectives for this section have been fulfilled. Answers are to be placed on the test. Scoring will not affect your term grade. It is your opportunity to identify tasks in which you still may be deficient. If the score is 80% or above, continue to the next section. If you score below 80%, restudy. See your instructor if you need guidance.

---

1. A fundamental law of electricity is that the current in a circuit is __?__.

   a. inversely proportional to the voltage
   b. equal to the voltage
   c. directly proportional to the resistance
   d. directly proportional to the voltage

2. Ohm's Law expresses (I) current as: (D-1)

   a. $E^2 \times R$
   b. E divided by R
   c. R divided by E
   d. E x R

3. When using any form of Ohm's Law, how many values must be known?

   a. three
   b. none
   c. one
   d. two

4. If the current in a circuit containing a resistance of 10 ohms is 2 amperes, the value of the voltage impressed across the circuit is __?__.

   a. 5 volts
   b. 20 volts
   c. 25 volts
   d. 15 volts

5. In order to double the electron flow through a given resistor the voltage must be __?__.

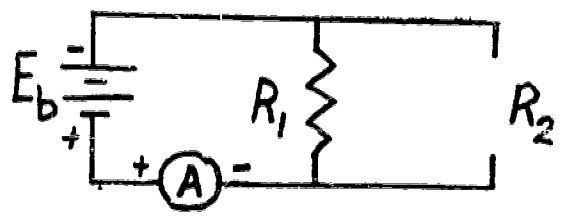
   a. decreased to one half
   b. decreased to one fourth
   c. doubled
   d. quadrupled

6. In an electric circuit, if the current is 20 amperes and the source voltage is 400 volts, the circuit resistance is __?__.

   a. 8000 ohms
   b. 420 ohms
   c. 20 ohms
   d. 380 ohms

7. In the diagram, to increase the value of current I from 1 ampere to 2 amperes without increasing E_b or changing R, the value of resistance to be connected across R is __?__.

   a. 10 ohms
   b. 100 ohms
   c. 1000 ohms
   d. 1 ohm



8. An electronic device draws 1.8 amps when connected across a 90 volt source. How much voltage will be needed to raise the current to 3.6 amps?

   a. 45 volts
   b. 36 volts
   c. 67.5 volts
   d. 90 volts
   e. 180 volts

9. If the impressed voltage in a given circuit is held constant and the resistance is doubled, the current will __?__.

   a. increase by one quarter
   b. increase by one half
   c. decrease by one quarter
   d. decrease by one half

10. A certain motor needs 8 amperes at 209 volts to operate properly. If it is to be used 600 feet from a 225 volt source the maximum amount of resistance the line can have in ohms is __?__.

    a. two
    b. four
    c. six
    d. eight

For additional information, check with the Auxiliary Lab Manuals in the Resource Center under OHMS' LAW.

TOPIC TWO

MATH PREFIXES AND POWERS OF TEN

A. OBJECTIVES

(_____) 1. Given the prefixes micro, milli, mega and kilo, the student will be able to relate these values to the fundamental unit and/or convert them to powers of 10. (p. 9-12)

(_____) 2. Given voltmeters marked in the units "Kilovolt," "Millivolt," and "Microvolt," the learner will be able to quickly translate these readings into volts. (p. 9-12)

(_____) 3. Given ammeters marked in the units "milliamp" and "microamp," the learner will be able to translate these units into amps. (p. 9-13)

B. STUDENT ASSESSMENT

DIRECTIONS: Check (✓) one of the following tracks and pursue the action indicated.

(_____) I understand ALL of the tasks indicated in the above stated objectives and therefore wish to take the self-test found at the end of this section. (p. 9-14)

(_____) I understand PART of these tasks identified in the above objectives and will study those with which I am unfamiliar. When completed, I will take the self-test.

(_____) I understand NONE of the tasks identified in the above objectives and will proceed in the order recommended in this packet, beginning on the next page. When completed, I will take the self-test.

TOPIC TWO

MATH PREFIXES AND POWERS OF TEN

A. OBJECTIVES

(_____) 1. Given the prefixes micro, milli, mega and kilo, the student will be able to relate these values to the fundamental unit and/or convert them to powers of 10. (p. 9-12)

(_____) 2. Given voltmeters marked in the units "Kilovolt," "Millivolt," and "Microvolt," the learner will be able to quickly translate these readings into volts. (p. 9-12)

(_____) 3. Given ammeters marked in the units "milliamp" and "microamp," the learner will be able to translate these units into amps. (p. 9-13)

B. STUDENT ASSESSMENT

DIRECTIONS: Check (✓) one of the following tracks and pursue the action indicated.

(_____) I understand ALL of the tasks indicated in the above stated objectives and therefore wish to take the self-test found at the end of this section. (p. 9-14)

(_____) I understand PART of these tasks identified in the above objectives and will study those with which I am unfamiliar. When completed, I will take the self-test.

(_____) I understand NONE of the tasks identified in the above objectives and will proceed in the order recommended in this packet, beginning on the next page. When completed, I will take the self-test.

TOPIC TWO

MATH PREFIXES AND POWERS OF TEN

RECOMMENDED MEDIA

(_____) 1. 16 mm film. No. 116D, Math Prefixes (25 minutes). Best for 1st part of Objective #1. Found in the Resource Center.

(_____) 2. 16 mm films. No. 116B (18 minutes) and No. 116C (25 minutes). Powers of Ten, Division and Multiplication. Excellent for beginning coverage of Objective #1. Found in the Resource Center.

(_____) 3. Tape-Slide presentation. Unit I, Powers of Ten, 2nd part. Brief, accelerated overview. Found in the Resource Center.

(_____) 4. Source of student's own choosing. _____

TOPIC TWO

MATH PREFIXES AND POWERS OF TEN - STUDY GUIDE

OBJECTIVE #1 Given the prefixes micro, milli, mega and kilo, the student will be able to relate these values to the fundamental unit and/or convert them to powers of 10.

---

1. What function do prefixes serve in electronics?

2. Why do we use the term fundamental unit in relating prefixes to electronics?

OBJECTIVE #2 Given voltmeters marked in the units "Kilovolt," "Millivolt," and "Microvolt," the learner will be able to quickly translate these readings into volts.

---

3. Many voltmeters are calibrated in the units "Kilovolt," "Millivolt," and "Microvolt."

   A. State the rule to follow when converting

      Kilovolts to volts:

      Millivolts to volts:

      Microvolts to volts:

   B. How many volts is expressed by each of the following:

      5 Kilovolts = _____ volts

      60 millivolts = _____ volts

      300 Microvolts = _____ volts

OBJECTIVE #3 Given ammeters marked in the units "milliamp" and "microamp," the learner will be able to translate these units into Amps.

---

4. Most lab meters which measure current are marked in smaller, more sensitive units than the Amp. Examples are the milliamp (abbreviation is "ma") and the microamp (abbreviation is "ua").

   Note: 1000 ma = 1 amp 1,000,000 = 10^6 ua = 1 amp

5. Solve the following problems:

   1 amp = _____ma 1 amp = _____ua

   600 ma = _____amp 72 ma = _____amp

   635 ua = _____amp 6.1 ma = _____amp

   .24 amp = _____ma .05 amp = _____ua

   540 ua = _____ma

6. Solve the following problems

   52 ma = _____amp

   .6 amp = _____ma

   18 ma = _____amp

TOPIC TWO

MATH PREFIXES AND POWERS OF TEN - SELF-TEST

My Score _____%

DIRECTIONS: This self-test is to be completed when you feel the objectives for this section have been fulfilled. Answers are to be placed on the test. Scoring will not affect your term grade. It is your opportunity to identify tasks in which you still may be deficient. If the score is 80% or above, continue to the next section. If you score below 80%, restudy. See your instructor if you need guidance.

---

1. "100 Millivolts" equals __?__.

   a. 100,000 V
   b. 1,000 V
   c. 1,000,000,000 V
   d. .001 V
   e. none of the above

2. "600 Microvolts" equals __?__.

   a. 600 V
   b. .06 V
   c. .0006 V
   d. none of the above

3. 100 ma equals __?__.

   a. 100,000 amps
   b. .100 amps
   c. .000001 amp
   d. none of the above

4. 65 ua equals __?__.

   a. .065 amp
   b. 65,000 amps
   c. 65,000,000 amps

5. "5 Kilovolts" equals __?__.

   a. .005 V
   b. .5 V
   c. 500 V
   d. 5000 V
   e. none of the above

6. .07 amp equals __?__.

   a. .00007 ma
   b. 70 ma
   c. 70,000 ma
   d. none of the above

For additional in-depth information, write the answers to the self-test in powers of ten and have it checked by the instructor.

Name_____

OHM'S LAW - PACKET EVALUATION #9

DIRECTIONS: The objective of this section is to enable you to reflect on the materials covered in the packet. Successful completion of this section will demonstrate to the teacher your learning accomplishments. Answer the following items when given permission by the instructor.

---

1. Explain in your own words the relationship between Ohm's Law and Kirchhoff's Law.

2. Give three reasons why powers of 10 and verbal prefixes are helpful in electronics.

   A.

   B.

   C.

SIGNATURE

(Additional Study) (Passed)

BIBLIOGRAPHY

Articles and Periodicals

Biggs, Leslie J. "A Procedure for the Design of a Multi-Media Instruction." Audiovisual Instruction (March, 1967), p. 228.

Bright, R. Louis. "The Pace of Technology in Educational Change." Audiovisual Instruction (April, 1967), p. 341.

Davies, I. K. "The Management of Learning." Industrial Training International (June, 1967), pp. 242-244.

Doty, Barbara, and Doty, L. A. "Programmed Instructional Effectiveness in Relation to Certain Student Characteristics." Journal of Educational Psychology (1964), pp. 334-338.

Eurich, Alvin C. "The Commitment to Experiment and Innovate College Teaching." Educational Record (Winter, 1964), p. 359.

From a summation statement at the symposium of educational technology, sponsored by the I.D.E.A., Division of the Charles F. Keetering Foundation, Today's Health, (September, 1967), p. 72.

Hodges, Lewis C., and Silver, Gerald. "Quickening the Pulse of Industrial Education." School Shop (April, 1968), p. 108.

Hilgard, Ernest R. "The Human Dimension in College Teaching." NEA Journal (September, 1965), p. 44.

Kemp, Jerrold, and Eastman, Stewart. "Teaching the One and Many--At the Same Time." Educational Screen and Audiovisual Guide (November, 1964), p. 26.

Jelden, David L. "Learner Controlled Education." Journal of Industrial Arts Education (November-December, 1967).

Lauda, Donald P. Industrial Arts and Vocational Education (December, 1967), p. 36.

Mararagno, Ralph J. "Two Methods of Adapting Self-Instructional Materials to Individual Differences." Journal of Educational Psychology (December, 1967), p. 327.

Norbert, Kenneth. "The Role of the Media Professional in Education." Audiovisual Instruction (December, 1967), p. 1027.

Porter, D. "Teaching Machines." Harvard Graduate School of Education Association Bulletin, March, 1968, p. 70.

Books

DeCecco, John P. Educational Technolog New York: Holt, Rinehart, and Winston, 1964.

Husband, Richard W. General Psychology. New York: Farrar a 1 Rinehart, Inc., 1949.

Merry, Frieda K., and Merry, Ralph V. The First Two Decades. New York: Harper and Brothers, 1950.

Wert, James E.; Neidt, Charles O.; and Ahmann, Stanley J. Statistical Methods in Educational and Psychological Research. New York: Appleton, Century, Crofts, Inc., 1954.

Reports

Brown, James W., and Thornton, James Jr. New Media in Higher Education. Washington, D.C.: Association for Higher Education and the Division of Audio-visual Instruction Service of the NEA, 1963.

Edwards Personal Preference Schedule. New York: The Psychological Corporation, 1959.

Ely, Donald P. The Changing Role of the Audiovisual Process in Education: A Definition and a Glossary of Related Terms. U.S. Office of Education Project Nr. SAI-9073 under Part B, Title VIII, NDEA. University of Southern California, 1963.

Gruber, Howard E., and Wertman, Morris. Self Directed Study: Experiments in Higher Education. U.S. Office of Education, National Defense Education Act of 1958, Title VII, Project No. 761. Boulder: University of Colorado Behavioral Research Report No. 19, 1962.

Harvey, O.J., "The Alienated in Education: A Psychological View," Colorado Journal of Educational Research. University of Northern Colorado, Volume 8, No. 3, Spring, 1969.

Fund for the Advancement of Education. Four Case Studies of Programmed Instruction. Report prepared for the Office of Education, Department of Health, Education and Welfare. New York: The Fund for the Advancement of Education, 1964.

Moore, Willim J.; Smith, Wendell I.,; and Teevan, Richard. Motivational Variables in Programmed Instruction. U.S. Office of Education, Title VII, Grant No. 7-48-0070-149.1. Lewisburg, Penn.: Bucknell University, no date.

Smith, M. Daniel. New Instruction Media: Self Instruction, Guided Instruction, and the Role of the Teacher. U.S. Office of Education, Project Nr. 143, Title VII, NDEA. Earlham College, no date.

United States Department of Labor. Guide to the Use of the General Aptitude Test Battery. Washington, D.C.: Government Printing Office, 1962.

Wing, Richard L. Use of Technical Media for Stimulating Environments to Provide Individualized Instruction. Cooperative Research Project No. 1948, supported by the U.S. Department of Health, Education, and Welfare under a contract with the New York State Education Department. Bedford Hills, N.Y.: Board of Cooperative Educational Services, Westchester County School District, 1963.

Unpublished Material

Stewart, Donald K. "A Learning Systems Concept as Applied to Courses in Education and Training." (Mimeographed.)

Sullivan, Thomas W. "Predicting Success in Vocational-Technical Programs in Community Colleges Using the General Aptitude Test Battery." Unpublished Ed.D. dissertation, Colorado State College, 1967.